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AUGUST 1996 ISSUE #89

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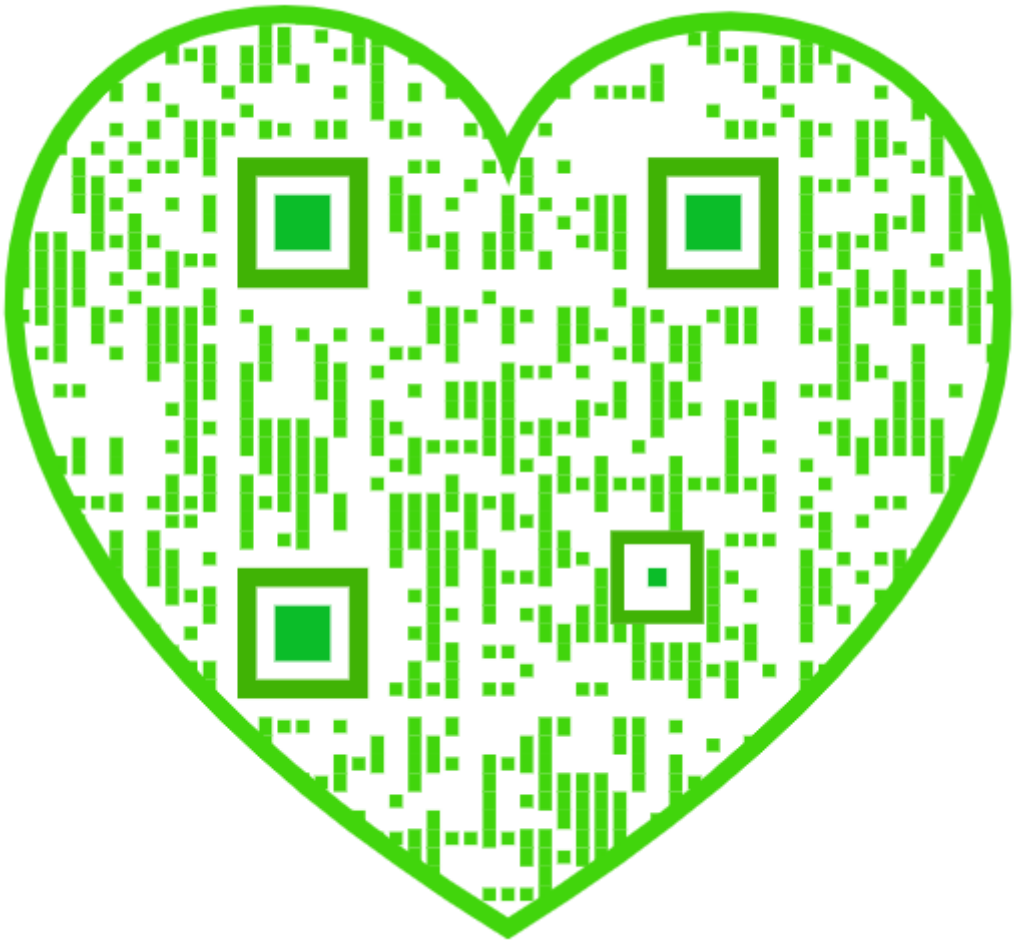

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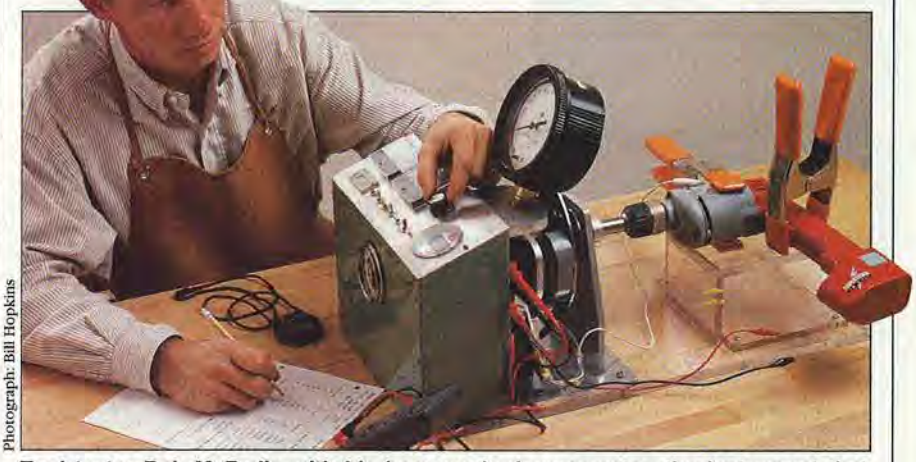
THE EDITOR'S ANGLE

Definitely above and beyond the call



Photograph: Bill Hopkins

Tool tester Bob McFarlin with his homemade dynamometer, the instrument that allowed him to take an in-depth look at over 40 cordless drills for the article beginning on *page 56.*

Sometimes, despite our very best efforts, we land in hot water with manufacturers when we publish the results of our tool tests. So you can rest assured that when it comes time to research and write any tool review, we try to be extra-careful that we do our job as accurately and thoroughly as possible.

Take the cordless-drill article in this issue, for example. Until we took on this tool category, the standard test used by evaluators had been to see how many screws a fully charged drill will drive, or how many holes it will bore.

But to Bob McFarlin, the tool tester who provided us with the data for the article, that wasn't good enough. He figured that the only objective way to evaluate the tools was by hooking each of them up to a dynamometer. So he built the one shown in the photo *above*. The "dyno" (that's the way Bob refers to it) provides exact readouts of speed, torque output, and total revolutions.

Bob told me that he's always trying to find ways to eliminate human error and personal opinions in his testing. But why go to all the effort to build his own instrument? He cites several reasons, the chief of which is that with a dynamometer he can put an exact workload on each drill with a pair of electromagnets and maintain it until the battery pack is exhausted.

Bob used other instruments to measure such critical factors as voltage, battery-pack and tool-housing temperatures, and run time. All of these results were used to make the recommendations in the article.

What I'm talking about here folks is the most accurate and informative test ever done on cordless drills by any woodworking publication. Take a look at this article; I think that you'll be mightily impressed.

And Bob, thanks to you and Dave Henderson (our other tool tester) for your dedication to tool-testing excellence. It shows.

Larry Clayton

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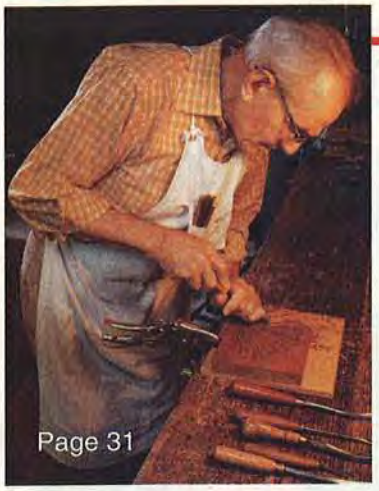
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Elevate the decor of your home's favorite eating spot with our roomy hardwood table. Turned legs can be purchased from our source.

42 How to turn look-alike legs
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This issue's cover wood grain: red alder

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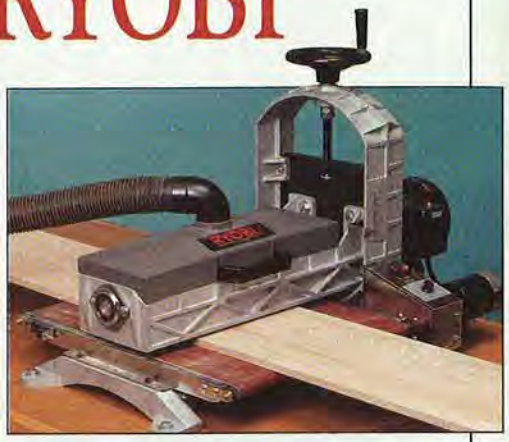
We test two similar drum sanders

PERFORMAX VS. RYOBI



Until recently, the Performax 16-32 Plus was the only open-ended drum sander priced under $1,000. Then, Ryobi introduced a similar-looking machine dubbed the WDS1600 selling for about $300 less ($599 vs. $899). Both prices exclude an optional stand. This big price difference really stirred my curiosity, so I ordered both machines and put them to the test.

Right out of the box, I noticed several things that account for at least part of the price difference. First, the Performax machine is assembled in the United States from mostly U.S.-manufactured parts (including a Leeson motor). The Ryobi is made in Taiwan. Mating surfaces between critical components are better machined on the Performax. And, I found the assembly and adjustment instructions for the Performax much more thorough and complete. (Representatives of Ryobi tell me they have beefed up the manual considerably since my test. They are sending new manuals to all registered owners.)

Next, I set up the machines, adjusted the drum and conveyor parallel with each other, and sanded a variety of workpieces. Here's what I discovered.

Performax 16-32 Plus

The sanding-head and conveyor-belt mechanisms of the Performax unit come in separate boxes, but were a snap to assemble. Adjusting the conveyor tension, setting the drum parallel to the conveyor, and securing 24- through 220-grit abrasives onto the drum all proved relatively easy and straightforward.

With the machine adjusted, I used a dial indicator to test for deflection at the unsupported end of the sanding drum. Under a sanding load, the Performax drum deflected .003"—well within acceptable tolerances.

My test workpieces did not show any snipe. And, their thickness varied only .002" side-to-side and end-to-end—excellent by my standards.

Ryobi WDS1600

This machine comes with a set of shims for adjusting the conveyor parallel to the sanding head. This difficult task was further complicated because my machine did not have enough shims. So, I had to adjust the two bolts that hold the upright motor/sanding head support. (My Ryobi contact tells me that current units have additional packing to better hold factory-set parts during shipping.)

After making these adjustments, the sanding head deflected .035" at its far end. To remove this play, I tightened the four bolts that hold the motor. This proved tricky because when I tightened the bolts too much, the sanding head would not elevate up and down. I eventually adjusted the machine so it would sand boards to within .004" of parallel over their faces—also excellent. But, at this tight tolerance the sanding head of the Ryobi does not elevate with the ease of the Performax.

The sandpaper-retaining clips were similar to those on the Performax, but were harder to access and operate. I had difficulty securely fastening abrasives under 80-grit.

The final analysis

Both machines are capable of producing excellent results. But, getting to that point with the Ryobi requires considerable effort and some mechanical aptitude on your part.

Are these trade-offs worth the $300 savings? Woodworkers I've spoken to are about evenly split on this issue; it pretty much depends on your budget, and how much tinkering you want to do with the machine now and in the future.

—Tested by Bob McFarlin

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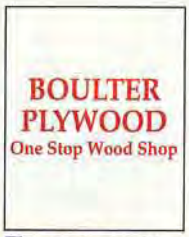

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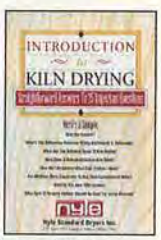

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No more skid marks on plastic laminates

I read with interest "How to Apply Plastic Laminates" in the August 1995 issue. I have a tip for eliminating the router marks when trimming the edge of a shelf or top with a router bit. Just apply a thin coat of petroleum jelly to the laminate on the edge. Then, trim with the router, and wipe off the petroleum jelly after completing the trimming.

—Bob Merrill, Wilbraham, Mass.

Reader wants a slower-setting glue

I found the June 1995 article "Today's Advanced Woodworking Glues" interesting because my current projects require a glue with great strength but a slow drying time. I see that Gorilla Glue and Excel both offer 20-minute open time. Are there other glues on the market that have an even longer open time?

—Paul Nye, Ossining, N.Y.

Yes there are, Paul. We found Slo-Set Glue offered by Garret Wade (1 pint of Slo-Set, part #62J04.01, priced at $6.95), which has a 30-minute open time. This is a slow-drying aliphatic resin glue with holding properties similar to other woodworker's glues on the market.

Weldwood Resorcinol Glue also has a longer open time than many other wood glues. This two-part glue has a 2-hour pot-life after being mixed, and an open assembly time of 25 minutes. Resorcinol Glue has the additional benefit of being waterproof. However, it will produce a noticeable dark line at the glue joint when used to fasten light-colored woods.

Continued on page 14

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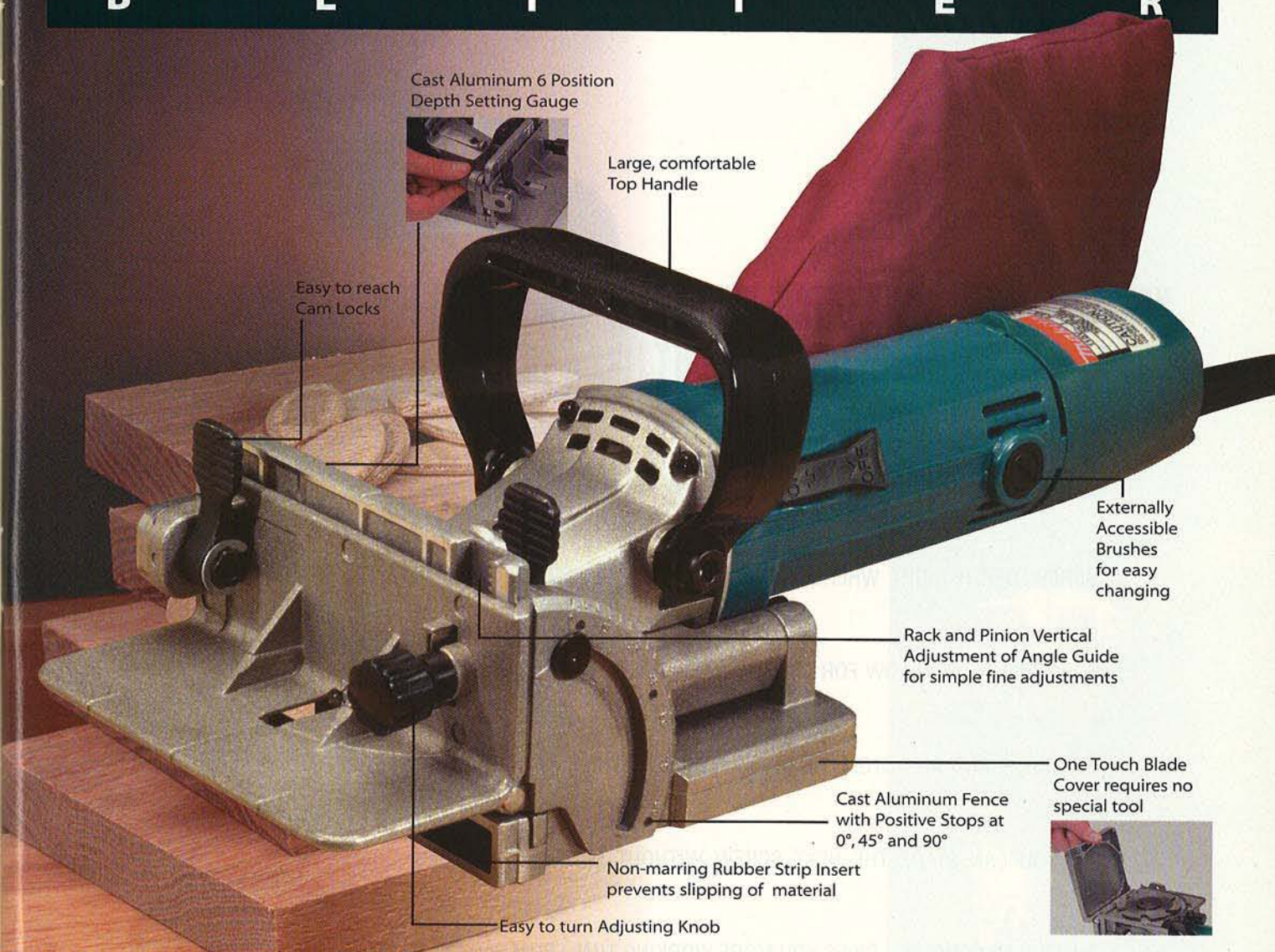
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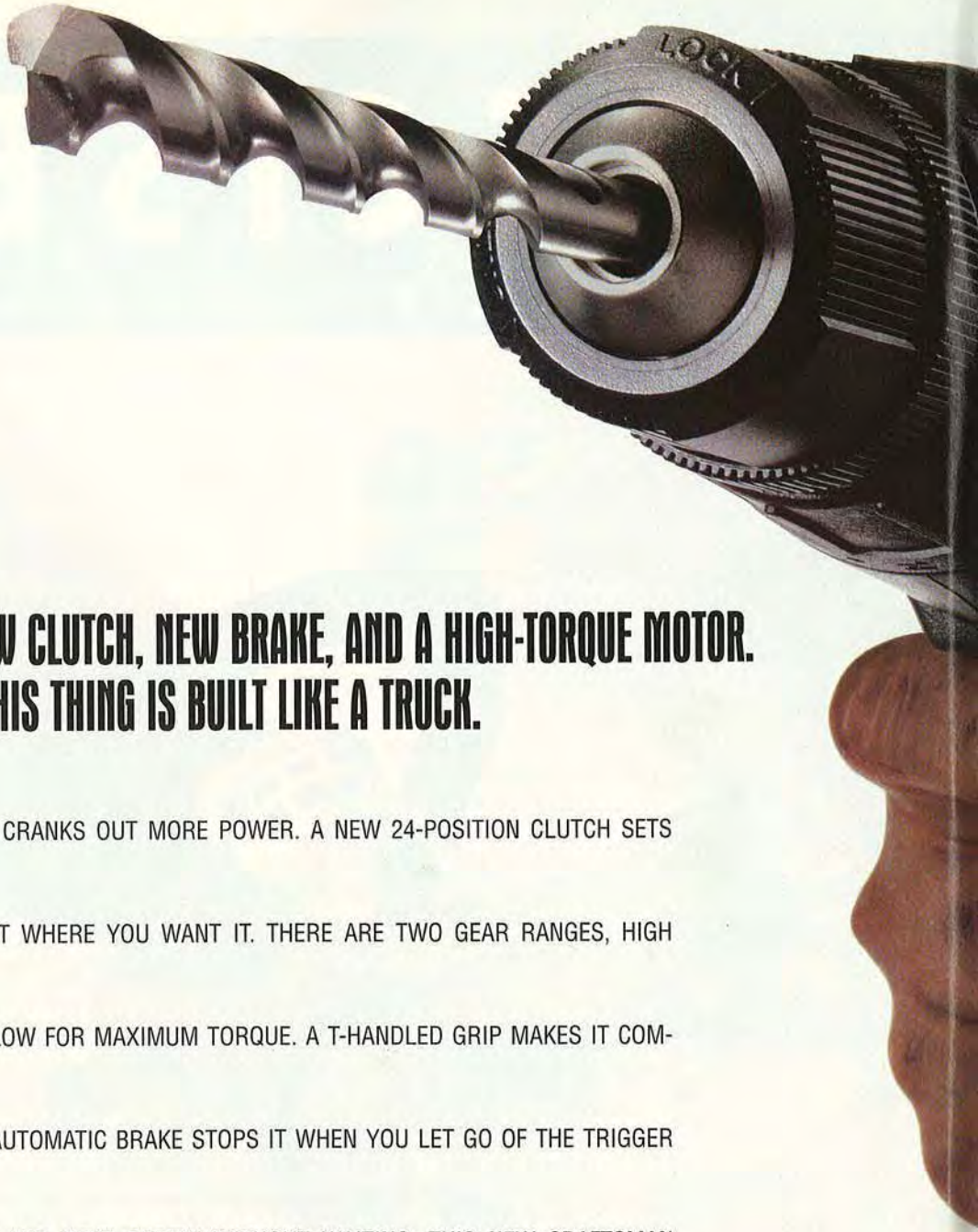

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SEARS/CRAFTSMAN
INDUSTRIAL
3/8" DRILL/DRIVER

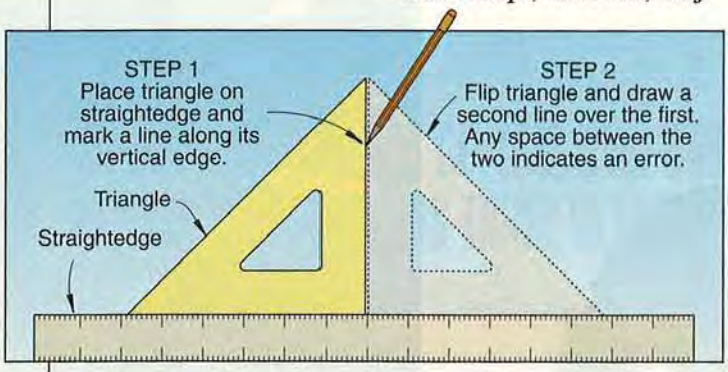
Continued from page 10

Check your triangle for square

The article "Tuning Up Your Power Tools" in the October 1995 issue stated that you used a drafting triangle, but you did not mention a method for testing the triangle's accuracy. Here is one I use:

Place a straightedge over paper on a level surface, and place one of the short legs of the drafting triangle on the straightedge (see the drawing *below*). Draw a line on the vertical edge of the triangle. Now, flip the triangle horizontally, and redraw a second line over the first. Any visible distance between the two lines indicates an error.

—Alan Phillips, El Cerrito, Calif.


STEP 1
Place triangle on straightedge and mark a line along its vertical edge.
STEP 2
Flip triangle and draw a second line over the first. Any space between the two indicates an error.
Triangle
Straightedge

Readers, can you help?

In the January 1992 issue of *WOOD*, we featured a story on John Starr's process of wood "stabilization." John's process of injecting liquid acrylic resins into wood under pressure made the wood stable, water resistant, and colorfast. "Stabilized" wood that would otherwise be too soft or unstable to work could be handled normally after treatment.

A piece of spalted maple before stabilization (top) and after stabilization.

But John's company, Material Stabilization Specialists, Inc., is no longer in business. So we're putting out a call to anyone who knows of a company that does wood acrylic-impregnation. Please contact us at the addresses listed on *page 10* so we can share the news with our readers.

—The Editors

Continued on page 16

"Jorgensen" E-Z HOLD™II

THERE ARE NO TWO WAYS ABOUT IT!

Imagine the ease and convenience of a clamp that provides both bar and spreader applications in one tool! The revolutionary "Jorgensen" E-Z HOLD™II is performance engineered with a double sliding-head design and in-line advancing handle... maintains greater applied force than other one-handed clamps. It's the most versatile, affordable, high quality clamp you can buy... no two ways about it!

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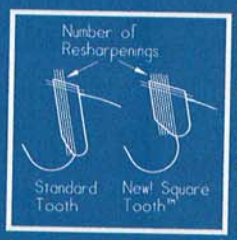
For our catalog send $1.00 to:
Adjustable Clamp Co.,
410 N. Ashland Ave., Chicago, IL 60622

Wanna' hear the latest in saw blades? You can't!

You can't, because these new blades are absolutely quiet and vibration-free. All other blades vibrate. If you don't believe us, take the blade you're currently using, hold it by the arbor and tap it with a pen or pencil. Hear the ringing noise? That's the vibration, the same thing that happens when you make a cut. Now, tap the blade on this page. No really — try it! That's what our new blade sounds like.

Vibration does more than just make noise. It causes teeth to dull faster and makes the cut less precise. So how do we eliminate vibration? We laser cut patented anti-vibration reeds right into the blade body. The sound gets trapped in the reeds and there you have it, no vibration.

Effect of vibration in the blade.



Not only is this the quietest blade, but the most precise. Why? Vibration causes micro-chipping on the edge of the workpiece and the kerf width to vary. We've also incorporated Freud's innovative new Square Tooth™ design — by taking the same amount of carbide as in our other blades and reshaping the tooth to make it thicker and shorter. A shorter tooth is less likely to follow the grain of the wood, thus permitting a more precise cut. A thicker tooth will also yield more sharpenings, extending the life of the blade. Also, our Titanium super micro-grain carbide lasts longer between sharpenings than other manufacturers' carbide.

A higher tooth angle prevents splintering and chipping. So we increased the bevel angle for each blade to give you a splinter-free cut. We have 3 blades to handle any woodworking project: 40 tooth ATB general purpose, 60 tooth triple chip for man-made materials, and 80 tooth ATB crosscutting.

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PS - For those of you that size is an issue, our Bandsaws range from 13" to 36" models.

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TALKING BACK

Continued from page 14

Mail-order kits no longer available

Grand River Workshop, one of the furniture-kit suppliers mentioned in the article "The *WOOD*® Gang Builds Kit Furniture," in our February 1996 issue, is no longer in business. Although the company was operational at the time we produced the article, its telephone numbers have been disconnected.

Missing patterns for the Treasure Tower

The *WOOD PATTERNS*™ insert in the center of our June 1996 issue is missing the full-sized patterns for the uprights (E) for the "Treasure Tower" project. If you're building this project, please write us at the addresses on *page 10*, or call us at 800/374-9663, and we'll send you the patterns. Our apologies for the inconvenience.

Using the right double-faced tape

I have been trying to make the intarsia duck design for the "Wild-Kingdom Coatrack" in the September 1993 issue, but I'm having trouble with my scrollsawing. You suggest double-faced tape to hold the pieces of ¼"-thick wood together while scrollsawing, but I haven't been able to find a tape of this type that will work. What tape do you suggest I use?

—Don Snell, Cutler, Ind.

It's important to use the right tape for the job, Don. The most common double-faced tapes are plastic film-backed and cloth- or fiberglass mesh-backed. We use the fiberglass type in our shop. It is available in Ace or True Value store brands. The plastic film-backed tape is not suitable for shop work.

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It's nice to know you can count on the power of Craftsman wet/dry vacs. With its ability to pick up one gallon of water per second, our 16 gallon vac approaches the power of a fire truck.*

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There are four Craftsman wet/dry vac models to choose from. You can see them all at your Sears store.

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Only at Sears

*One 100' length of 1" hose with a nozzle pressure of 50 psi and engine pressure of 125 psi will deliver 68 gallons per minute.

How do you clamp something that most clamps will crush? For an answer, see the tip *right*.

In our shop here at *WOOD*® magazine, we have clamps that range from 6" to 6' long. But when it comes to clamping small parts and miniatures, most clamps aren't small enough or gentle enough.

So when I saw Bill Rohde's clothespin clamping tip *right*, I knew we had a winner that will please anybody who has ever struggled with small-stock glue-ups. Like Mr. Rohde, perhaps you've come up with some clever jigs or techniques of your own. If so, we want to know about them. We'll pay you $40 if we select your tip for publication, and you'll be eligible to win a tool prize for the best tip of the issue. To be considered, send a letter with a photo or drawing of the tip to:

Tips From Your Shop
(and Ours)
***WOOD*® Magazine**
1912 Grand Ave.
Des Moines, IA 50309-3379

We try to publish only original shop tips, so please send your idea to just one magazine. Also note that we cannot return submissions. Thanks!

Bill Krier

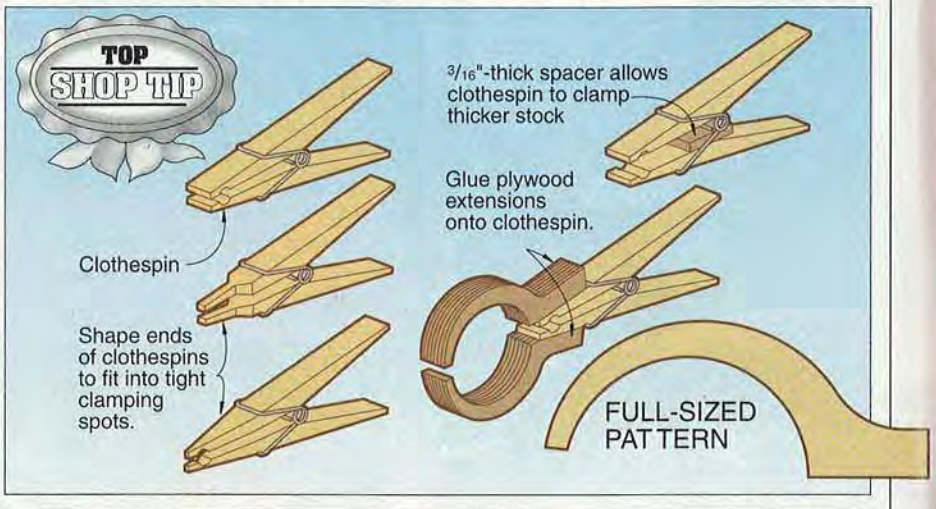
ASSISTANT MANAGING EDITOR

Custom clothespins clamp tiny details

When you're gluing miniatures or small pieces of stock, even the smallest conventional clamps often turn out to be too big or exert too much pressure. So if you sometimes feel like Gulliver wrestling with a Lilliputian-size project, head for the grocery store and pick up a bag of clothespins. You can use the clothespins as they are to clamp flat stock. But for things like half-rounds, buttons, and extra-small details you can custom shape the ends of the clothespins like the examples shown *below*.

Bill Rohde, Germantown, Tenn.

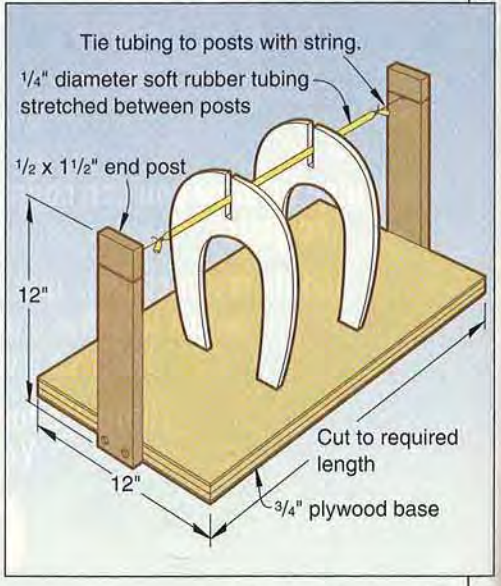
Bill Rohde, our top shop tip winner for this issue, receives a Sears model 23616 23" scrollsaw for his effort.


TOP
SHOP TIP
Clothespin
Shape ends of clothespins to fit into tight clamping spots.
3/16"-thick spacer allows clothespin to clamp thicker stock
Glue plywood extensions onto clothespin.
FULL-SIZED PATTERN

Try plastic tubing to hold small parts for painting

The next time you need to paint small, notched parts for a project (such as the legs for the tabletop reindeer in the November 1994 issue of *WOOD*® magazine), build one of these racks. Buy a suitable length of clear-plastic tubing at the hardware store with an outside diameter just a bit larger than the notches in your project. Then, tie string around the ends of the tubing and stretch it across a rack like the one shown *right*. Slip the notches in your project parts around the tubing and they'll stay put during paint application and drying.

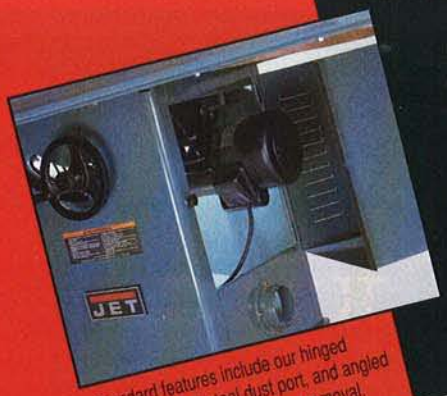
—T.W. Mohr, Whitehall, Pa.


Tie tubing to posts with string.
1/4" diameter soft rubber tubing stretched between posts
1/2 x 1 1/2" end post
12"
12"
Cut to required length
3/4" plywood base

Continued on page 20

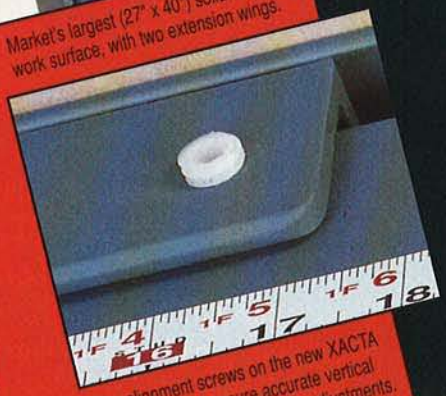
Don't just take our word for it.

Listen to the experts



Standard features include our hinged motor cover, 4" steel dust port, and angled cabinet floor for efficient dust removal.

Market's largest (27" x 40") solid cast iron work surface, with two extension wings.



The alignment screws on the new XACTA FENCE™ head ensure accurate vertical and horizontal fence-to-blade adjustments.

Slickstuff™ fence side panels are smoother than Teflon® and easy to interchange or replace.

"Good features, performance, and value. Delta and Powermatic, watch out!"
December '95 issue of American Woodworker

"Should prove to be an excellent shop workhorse and provide long, satisfactory service."
Jan./Feb. '96 issue of Woodworker's Journal

"The first thing we noticed was that the fit and finish were exceptional."
Jan./Feb. '96 issue of Fine Woodworking

JET's 10" tilting arbor tablesaw. The experts were impressed by the cast iron trunnions, three matched v-belt drive, deluxe mitre gauge, and more—all backed by JET's two-year warranty. And now, JET introduces the XACTA FENCE™ System. For more information about JET's complete line of quality woodworking tools, or to order a free demo video of JET's exceptional 10" tilting arbor tablesaw, call 1-800-274-6842.

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- Slot Mortiser / Horiz. Borer
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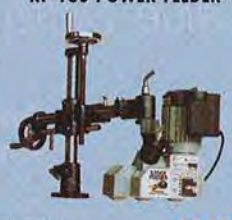

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Circle No. 15

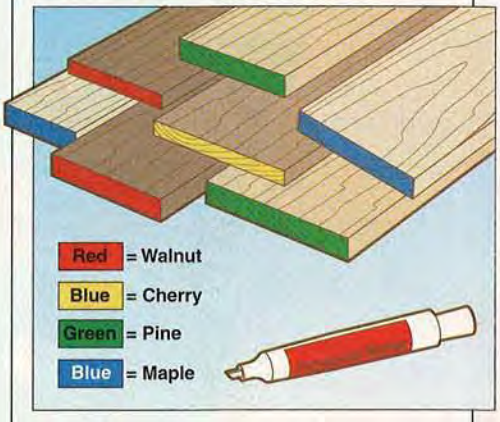
TIPS FROM YOUR SHOP (AND OURS)

Continued from page 18

Color-code your lumber to avoid confusion

When all you're looking at are the ends of boards stacked up in your shop, it's often difficult to tell one species of wood from another. To avoid confusion, take a tip from the lumber stores. Every time you store a board, color-code the species by marking the endgrain with a thick felt-tip marker.

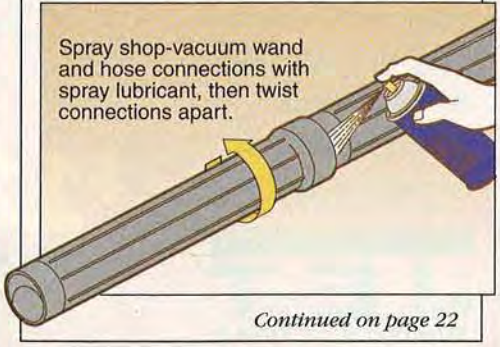
—R. Phillips, Reading, Pa.



Lubricant loosens vacuum connections

If you get grit and dust on your shop-vacuum wands, they may stick together so tightly that you can't pull them apart. When this happens, try squirting a little WD-40 spray lubricant around the connection. Let the lubricant sit for a minute, give the wands a twist, and they will come apart. To prevent this sticky situation in the future, lightly coat both mating surfaces with WD-40 and wipe them down with a cloth.

—Dan Wenciker, Jefferson, Ohio



Continued on page 22

Here's the Angle on Making the Cut...

From large stock to delicate finish work, our new 10" Magnum™ Slide Compound Miter Saw offers the capacity, accuracy and flexibility you demand. With a powerful 15 amp Milwaukee motor, 3-1/2" X 12" cross cut capability and patented Flip Fence, the Slider's got the capacity to handle both short and tall stock. Twin steel rails and the heavy-duty cast base for extra support assure accurate cuts every time. And its revolutionary override device lets you lock the table at virtually any angle. Allowing miter cuts from 59° right to 51° left, bevel cuts from -3° right to 48° left, compound miters and cross cuts, the Slider's versatile, too. The standard 6496-6 is equipped with a 40-tooth carbide-tipped blade and blade wrench. Also available: the 6497-6 Slider Kit, with extension and stop gauge, vise, and dust bag. For more information, call 414/783-8311. Fax 414/783-8529 or reach us on the internet at http://www.industry.net/milwaukee.electric

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550-1605

Continued from page 20

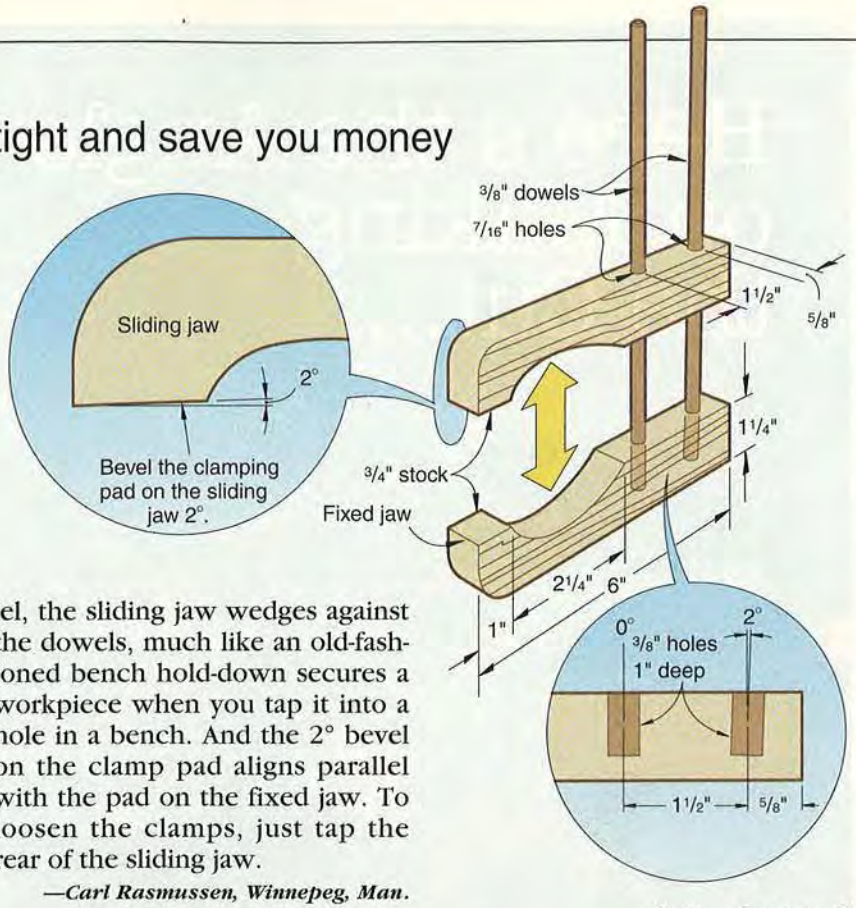
Shop-made clamps hold tight and save you money

Let's face it; clamps cost a fair amount of money. If you've got more scrapwood than tool dollars, you can help keep your budget in line by making these handy light-duty clamps.

To build the clamps, cut the jaws to the dimensions shown, or choose a size suitable for your needs. Lay out the center points for the dowel holes in the same position on the sliding and fixed jaws, but drill the rear dowel hole for the fixed jaw at a 2° angle as shown. Then, glue the dowels in the holes on the fixed jaw.

The secret to these clamps is in the 2° angle of the rear dowel and the 2° bevel on the clamp pad of the sliding jaw. The sliding jaw will move freely until you place a workpiece between the clamping pads and squeeze the jaws together. Since the dowels are not parallel, the sliding jaw wedges against the dowels, much like an old-fashioned bench hold-down secures a workpiece when you tap it into a hole in a bench. And the 2° bevel on the clamp pad aligns parallel with the pad on the fixed jaw. To loosen the clamps, just tap the rear of the sliding jaw.

—Carl Rasmussen, Winnepeg, Man.



Continued on page 24

TOOLS OF THE TRADE

Any woodworker knows that using the right tools for a project makes all the difference. That's why the Titebond® Family of Wood Glues has been the choice of professionals for more than 35 years. Recognized as the premier name in wood glues, Titebond has five specially-formulated glues for your next woodworking project.

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Index pin contains 36 - 10° spacings for accurate fluting and marking on workpieces. Left and right turning face plates and 6" and 12" tool rests. (Stand sold separately).

Distance between centers: 37"; Swing over bed: 12"; Spindle speeds: 575, 980, 1560, 2520 and 3580 RPM; Motor: 1/2 HP, 1725 RPM, 115V, 60 Hz AC, swing mounted to headstock; Drive spindle: No. 1 Morse taper plus 3/4-16 threaded; Tailstock: No. 1 Morse taper; 2-3/8" ram travel; Ship. wt.: 80 lbs.

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CENTRAL MACHINERY

16" SCROLL SAW

- Precision milled 14-1/2" x 8" table tilts 0° to 45° • 5-1/2" blade length
- Use either plain or pin end blades, 5-1/2" long • 1/8 HP, 110V, .83 amps
- Heavy duty cast iron frame and base reduce vibration • 7/8" blade stroke
- 1750 SPM blade speed

ITEM 34618-0VTA **$59.99**

5 PC. 5-1/2" SAW BLADES

- Plain end type

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SAVE $50

7" INDUSTRIAL RABBETING JOINTER WITH STAND

- Motor: 1 HP, 110V, 5.9 amps
- Max. depth of cut: 1/2"
- Rabbet cut: 1/2" • Cutting width: 7"
- Max. table dimensions: 42" x 6-1/2"
- Cutter head speed: 4655 RPM
- Rabbeting ledge: 3-1/4"
- 47-1/2" x 19-1/2" x 36-1/2"
- Fence tilt: 45°

ITEM 31849-2VTA **$249.99**

REPLACEMENT BLADE SET

ITEM 33272-1VTA **$17.99**

CENTRAL MACHINERY

SAVE $40 FROM OUR WINTER CATALOG

10" PLANER

- 2 HP, 110V, 1 phase, 11 amp, 8000 RPM
- 5-1/8" working distance
- 10-1/8" x 9-1/8" feed table
- 19" x 16-5/8" x 16" overall dimensions
- 10-1/8" blade size
- 2-blade cutter head
- 61 lbs. ship. wt. • Stand sold separately
- 2-blade cutter head

ITEM 32377-3VTA **$199.99**

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18 AND 19 GAUGE AIR FINISH NAILER

The excellent balance and 2-1/2 lb. weight make this brad tacker easy to use in tight spots. With a loading capacity of 105-18 gauge brads, you get more done in less down time. Using brads from 5/8" to 1-3/16", it will perform a variety of demanding tasks from picture frames to solid, homemade furniture.

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- 0-550 RPM variable speed
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Circle No. 46

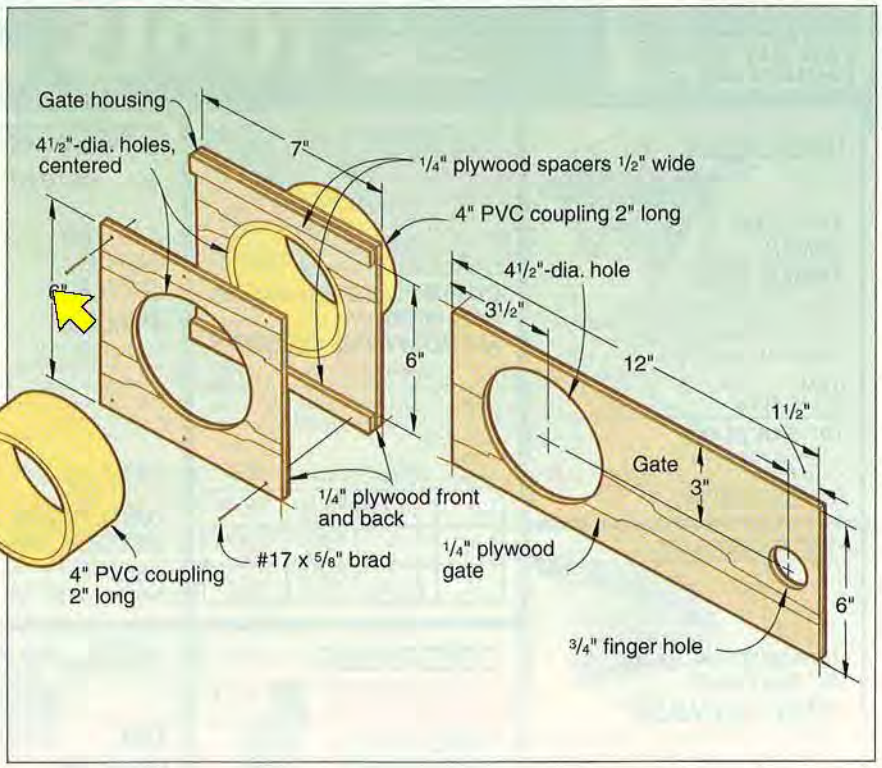
Continued from page 22

A quick-and-easy dust-collection blast gate

Here's a dust-collection blast gate you can build quickly and easily without spending much money. First, cut all the pieces from ¼" Baltic-birch plywood, and bore the 4½" holes as shown with a circle cutter. Then, glue and clamp the plywood spacers to one of the 6×7" plywood pieces. Now, cut a 4" section of PVC cold-water drain coupling in half, and epoxy the coupling halves to the 4½" holes, flush with the inside surface of the plywood.

When the glue and epoxy cure completely, assemble the two halves of the blast gate with glue and brads. Now, slide the gate into the gate housing, and connect your dust-collection piping to the PVC couplings.

—Eugene O'Hara, Independence, Mo.



Continued on page 26

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7536 2 hp Router 203
7537 2 hp D-Handle Rt'r 212
7538 3 hp Plunge Router 241
7539 VS Plunge Router 264
7549 Jig Saw 127
7800 Drywall sander 326
7810 Vacuum 239
9118 3 1/4" Planer Kit 213
9314 Trim Saw Kit 156
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96645 Screwgun w/ case 128
97310 Trimmer Kit 184
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9743 7-1/4" Saw Kit 139
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347K 7" Saw RH&case 127
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0236-1 1/2" Magnum Kit 157
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0379-1 1/2" Close Qtr Drill 149
0408-1 Cordless Kit-2batt 172
0422-1 12V Cordl's Hammr 245
3300-1 Rt Angle Drill 213
3107-1 VS Rt Angle Drill 225
5369-1 3/4" Falcon Kit 269
5371-1 1/2" Hammer Drill 187
5392-1 3/8" Hammer Drill 126
5397-1 3/8" Hammer Kit 148
5460 7" Polisher 179
5682 2 Hp Router 168
5936 4 x 24 Belt Sander 227
6008 1/3 Sheet Sander 123
6010 1/2 Sheet Sander 127
6148 NEW Mini Grinder 96
6175 14" Chop Saw 278
6266 NEW!! Jig Saw 149
6365 7-1/4" Saw 125
6460 10" Circular Saw 268
6491 10" Miter Saw 278
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31-460 4" Belt 6" Disc Sandr 126
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36-210 10" Compound Mit' 248
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40-560 16" Scroll Saw 168
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STSE380 Jig Saw 59
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Sale prices good thru 8/1/96.

FREE $45 IN SHARPENING COUPONS

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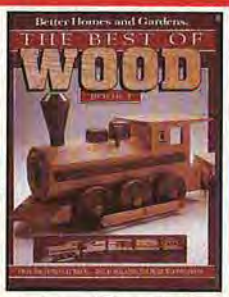

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ALL PURPOSE RIP & CROSSCUT

WOODWORKER II	LIST	SALE	10%	20%
12"X40TX1"	$183	$129	$116	$103
10"X40TX1/8" or 3/32"	$156	$119	$107	$ 95
8-1/4"X40TX 3/32"	$136	$ 99	$ 89	$ 79
8"X40T 3/32"	$136	$ 99	$ 89	$ 79

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THE ONE BLADE THAT LEAVES A SMOOTH-AS-SANDED SURFACE!

BUY OUR BEST SELLER 10" X 40T FOR ONLY $107 OR $95 ON SECOND BLADE.

RECEIVE WITH EVERY FORREST BLADE OR DADO LISTED, 9 SHARPENING COUPONS WORTH $5.00 EACH!

TRY A FORREST CARBIDE BLADE TODAY!

ONLY **$62 or $50** NET COST TO YOU AFTER USING SHARPENING COUPONS

Outperformed 36 other premium blades, both foreign and domestic!
WOOD® Magazine test, Sept. '93, pg. 45

> I just purchased your WOODWORKER II 3/32 blade, and I AM TICKLED PINK with it. My RYOBI BT 3000 saw acts like it had a 3 H.P. motor in it. Cuts so much easier and quieter and smoother. Don't need my jointer or sander now.
>
> P. Rose, PA

> After installing your blade and 5 in. stiffener the vibration in my saw went down another 20%. I ran several pieces of hardwood through the saw, both crosscut and ripping, and was amazed at the smoothness. It was like cutting butter, maybe smoother. I have never had a saw blade that cut this smooth.
>
> I also am going to send you my old Craftsman blade to sharpen. I'm not satisfied with our local sharpening. Now, how to justify another one of your blades.... because I don't ever want to be without one.
>
> Rick Price

CHOPMASTER FOR SLIDING COMPOUNDS & MITER SAWS

New specs, 5° Neg. Pts. & flat, runs out less than .002 for perfect, tight, smooth, splinter-free miter joints. **TAKE EXTRA 10% – 20% OFF COMBO SALE!**

NEW SIZES AVAILABLE	LIST	SALE
Delta Sidekick 6-1/2"x40Tx5/8"	$149	$ 89
Sears 8-1/4" & Delta 8-1/4"x60Tx5/8"	$170	$ 99
Hitachi 8-1/2"x60Tx5/8"	$179	$109
DeWalt 8-1/2" & Ryobi 8-1/2"x60Tx5/8"	$179	$109
Delta 9"x80Tx5/8"	$204	$119
Ryobi–Makita & all 10"x80Tx5/8"	$207	$129
DeWalt, Makita, B&D, Hitachi 12"x80Tx1"	$229	$139
Ryobi–Makita 14"x100Tx1"	$266	$179
Hitachi 15"x100Tx1"	$277	$189

For good general purpose cuts use Woodworker II 30T & 40T or Woodworker I. Use small stiffener where possible.

WOODWORKER I – CROSSCUT For TABLE and RADIAL SAW

	LIST	SALE
12"x60Tx1" or 5/8" 1/8"K	$198	$139
10"x60Tx5/8" 3/32"K	$162	$129
8"x60Tx5/8" 3/32"K	$150	$109

OTHER SIZES AVAILABLE

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8" D. 5/8" Bore	$321	$289	$260	$245
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(Bore up to 1-1/4" Add $25 — Plus $5.50 S&H)

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5/8" HOLES. Boring up to 1-1/4" $7.50 extra. Larger holes–time basis. Shipping $4.50.

Faster feed rates & absolute splinter control. Stops splintering on OAK/ BIRCH PLY VENEERS & MELAMINE.

SIZES AVAILABLE	LIST	SALE
7-1/4"x60Tx3/32" K	$149	$129
8"x80Tx1/8" & 3/32" K	$202	$169
9"x80Tx1/8" & 3/32" K	$207	$179
10"x80Tx1/8" & 3/32" K	$207	$159
12"x80Tx1-1/8"K	$212	$181

Other sizes available

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Standard C-2 Carbide (below, left) and FORREST **still sharp** Oxidation and Corrosion Resistant Sub-Micron C-4 Carbide (below, right). Each shown after cutting 3,500 feet of MDF. Similar results obtained cutting particle board, melamine, and plywood.

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Circle No. 1322

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Dan Nelson, Sacramento, CA.

A: Wood•Kote Jel'd Stain™, a true "gelled" stain, is often preferred by professional woodworkers for a number of reasons. First, Jel'd Stain™ will, on the average, cover three times the surface area of conventional liquid stains. Second, because Jel'd Stain™ holds a large amount of pigment, no stain controller is needed and it can be applied, even on soft woods, without blotching. Third, Jel'd Stain™ is easily applied with a cloth, leaving a beautiful, even finish with no brush or lap marks on the wood. There is no splatter and no stirring is required. Finally, Jel'd Stain™ is fast drying and can usually be top coated with Crystal Kote Lacquer™ or a polyurethane such as Ultra Poly Kote™, Cascade Poly Kote™, Flagship® UV, or Jel'd Poly Kote™ after only two hours.

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Circle No. 615

TIPS FROM YOUR SHOP (AND OURS)

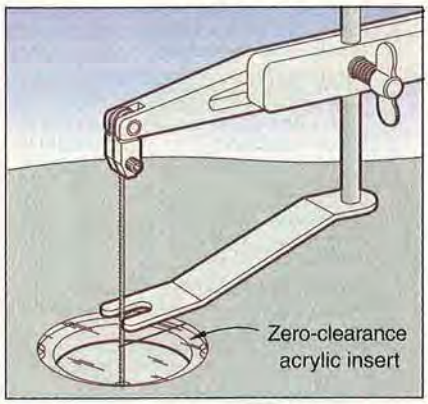
Continued from page 24

Throat plate prevents loss of small parts

Scrollsaws excel at cutting small pieces. But the smallest of these wooden parts have an annoying tendency of falling through the opening in the throat plate of the saw. To prevent this problem, build your own zero-clearance scrollsaw throat plates.

Cut your auxiliary throat plate from a piece of ⅛" acrylic to the exact outline of your saw's standard throat plate. If the ⅛" acrylic plate does not sit flush with your table, try a different thickness of acrylic, or shim the plate from below. Now, drill a 3⁄32" hole centered in the acrylic plate for the blade to go through. Then, scrollsaw a line from the edge of the acrylic plate up to the hole, and you're ready to go.

—Tony Lammers, Grand Rapids, Mich.



A FEW MORE TIPS FROM OUR WOODWORKING PROS

- Master furnituremaker George Reid shares tips and techniques from his 50 years of woodworking on *page 35*.
- Learn how to tenon the ends of dowels for custom fitting on *page 50*.
- Breadboard ends dress up the endgrain of edge-glued panels, and allow such panels to "move" with changes in humidity. See *page 36* for how we make this joint.

Come visit us on the Web!
Check out CMT's new Web site for special deals and lots of information.
http://cmttools.com/catalog/

How did I carve these?

I love the look of hand carved wood, with its warmth, beauty and unique personality. But hand carved cabinets, doors and furniture have always been beyond my budget and quite frankly, intricate carving has always been beyond my skills.

In fact, architectural carving is almost a lost art in this age of automation and mass-production woodworking. So when we found this three dimensional router carving system in Tasmania (an island off the southern coast of Australia) we had to have it.

The beauty of this system is that it carves in three dimensions. Router sign-carving systems only have two-dimensional patterns, but our system incorporates a unique angled template guide and special templates to produce true three-dimensional cuts.

Besides the expense and time required, traditional hand-carving has another limitation: it's very difficult to exactly duplicate a carving. The 3D Carving system allows you to produce any design once, twice or a hundred times! With the 3D System, cabinet shops and door makers can add a new dimension to their work. Furniture makers can add rosettes, corner designs and "hand carving" to their pieces.

Best of all, the 3D Carving System is very affordable, providing professional woodworkers with an excellent opportunity to add value and distinctive touches to their work.

Sincerely,
Carlo Venditto, C.E.O.

NEW!

Complete 3D Carver™ Pattern Set

46 full-size printed patterns!

Includes 42 pages of accurate drawings packed in a 3-ring binder

3DC-900
3D Carver Pattern Set,
List: $20.00 SALE: $14.90

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What is the 3D Router Carver™ System?

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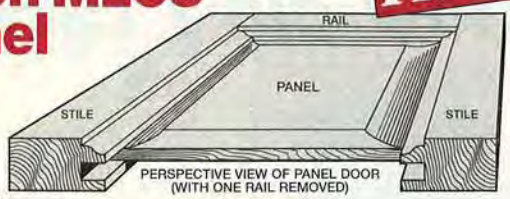

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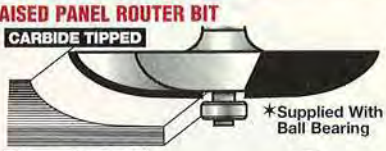
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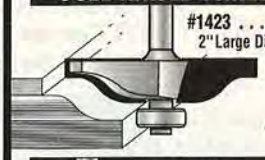
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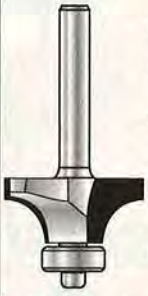
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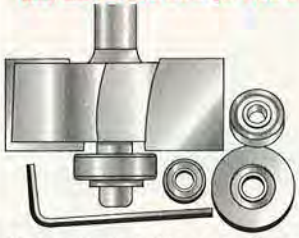
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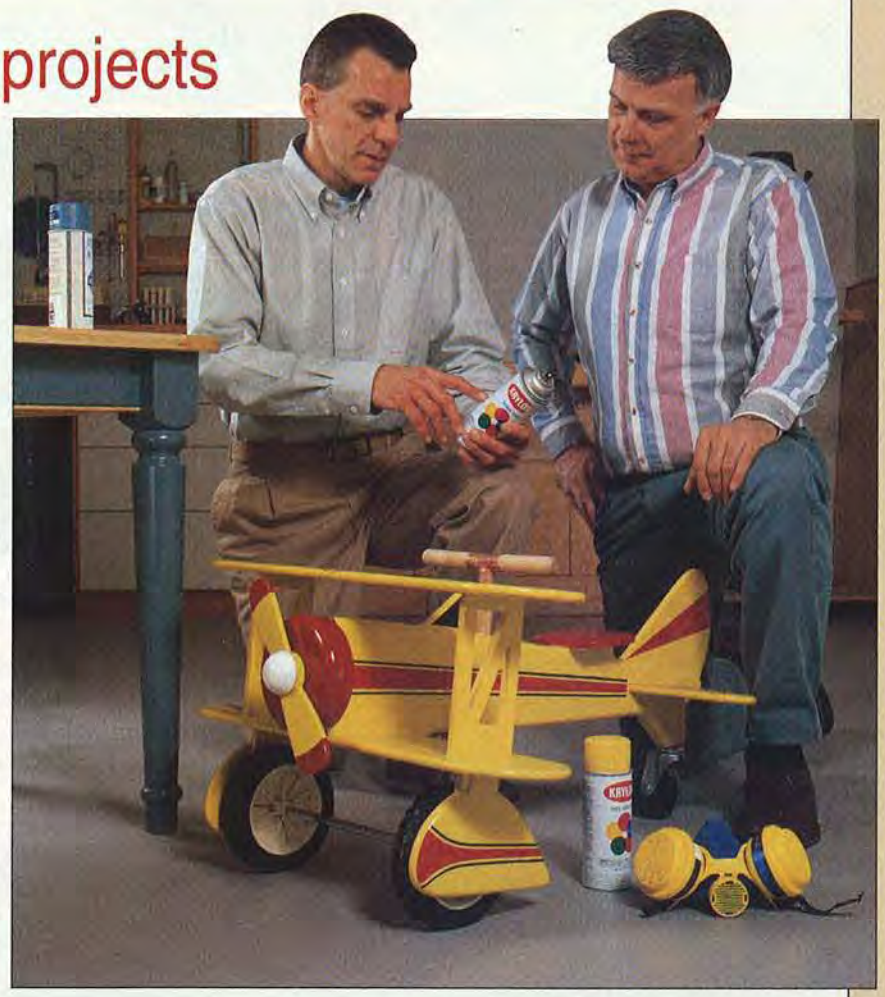
How to give your projects A PERFECT PAINTED FINISH



In the February 1995 issue, #77, we showed you how to spray-paint your projects with the finishes professional auto body shops use to paint cars. But there is a lower-tech way to a perfect spray finish–the one our project builders Jan Svec and Chuck Hedlund, *at right*, use all the time in the *WOOD*® magazine shop.

They buy off-the-shelf products and use their tried-and-true process to produce flawless finishes time after time. Here's how they do it.

First, fill and sand. No matter how hard you try, a small gap, dent, or scratch can remain on a project after final sanding. To level-out problem spots such as these, Chuck and Jan use Durham's Rock Hard Water Putty. But instead of mixing the powder with water as called for on the can, they mix it with yellow woodworker's glue. By doing this, the filler sets up faster and harder, and doesn't crumble.

After mixing the powder and glue to the consistency of sour cream, use a putty knife to apply the putty to the depression. The smoother you apply and level the putty now, the less sanding you'll have to do later. Let the putty dry thoroughly (about an hour), and sand the repaired area smooth. As shown in the photo *at right*, a sanding block works well. If the area is not perfectly smooth and flat, repeat the process.

OK, it's time to prime. A white primer coat on bare wood plays many roles in a silky-smooth finish. Primers contain more solids than paints do, making them ideal for sealing and filling a finely sanded surface. Acting as a uniform color backer for the paint to bond to, the primer also allows the true color of the paint to show through. For the projects shown here, we sprayed on Krylon White Sandable Primer. Sprayed directly onto bare wood, paints tend to darken or become slightly more yellow than their natural color. A primer coat also may raise the grain slightly. If it does, sand lightly to smooth the surface. It's better to have the primer raise the grain than the paint.

After filling the edges of plywood with our mixture, a sanding block is ideal for sanding it smooth and flat.

Note: *It is critical that you use a paint that's compatible with the primer. For instance, if you want to use a lacquer-based paint, use a lacquer-based primer. And although you can spray an enamel paint over a lacquer primer, the solvents in a lacquer paint*

Continued on page 30

A PERFECT PAINTED FINISH

Continued from page 29

will dissolve an enamel finish causing the paint to wrinkle.

To sand the primer, Chuck and Jan prefer 320-grit sandpaper. Not only does sanding level any little imperfections in the primer, it also highlights imperfections that are easier to smooth out now than during the painting process.

Our resident project painters give most projects one or two coats of primer. Porous end grain may need more primer to build up a smooth surface onto which you can spray the paint. Additional primer is also needed if you sand through the primer.

Now, check for imperfections. One of the best ways we know to do this is to shine a work light onto the surface and view the project from a low angle.

And now, for the paint. Chuck and Jan are unanimous in stressing the importance of *light wet coats* of paint, keeping the paint can nozzle the same distance from the project at all times. If you spray on too much paint at one time, you greatly increase the odds of runs and sags—problems that are difficult and time-consuming to even out. As shown in the photo *at right*, a bright light gives you a better idea of just how much paint you're putting on. But be careful, too, that you don't put too little paint on the surface. If your painted surface feels coarse, you're probably not laying down enough paint. Jan painted the table with American Accents All-Purpose Enamel (teal), and Chuck finished the plane with Krylon Interior/Exterior Paint (citrus yellow).

A can of spray paint in one hand and a bright light in the other is a perfect combination for even coats of paint.

How to repair a less-than-perfect paint job

If a scuff, fingerprint, or other surface imperfection mars your painted project, there's still hope. To remove tiny bumps left by shop dust, Chuck and Jan wet-sand painted surfaces with 600-grit wet/dry sandpaper. They're careful to keep the area being sanded and the sandpaper wet as shown in the photo *at right*. They keep a tray of water on hand for this operation. It takes only about six light passes to smooth out the roughness. When doing this, be extremely careful not to apply too much pressure or make too many passes and rub through the thin layer of paint.

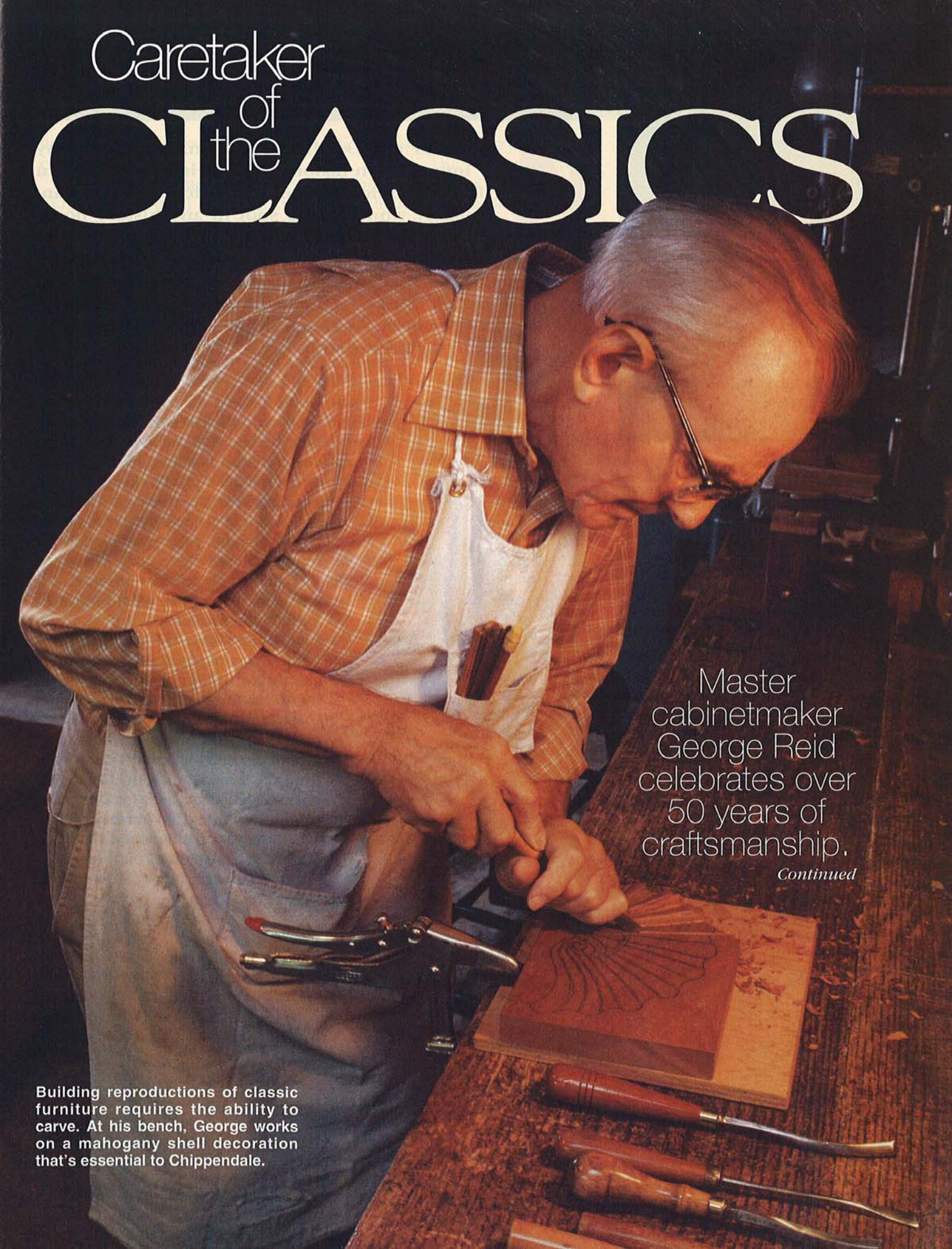
Keeping the project and sandpaper wet, use 600-grit wet/dry sandpaper to sand away imperfections or runs.

If the paint balls up under the sandpaper, the paint is not dry enough. If you notice lots of paint on your sandpaper, your paint is not dry enough or you're not using enough water.

After wet-sanding a painted surface, dry it with a clean cloth. The wet-sanding not only removes the dust-bumps, it also leaves dull spots. To restore the shine, follow these steps. First, rub the entire painted surface with #0000 steel wool (ultra-fine Scotch-Brite pads, the grey-colored ones, also work fine). Again, use a light touch, being careful not to rub through the paint to the primer. Then, wipe off the dust with a tack cloth, apply a paste wax with another clean cotton cloth, and buff the surface by hand to bring back the sheen. Our guys use Minwax Finishing Wax.

Written by Marlen Kemmet and Larry Clayton
Photographs: John Hetherington

Caretaker of the CLASSICS



Master cabinetmaker George Reid celebrates over 50 years of craftsmanship.

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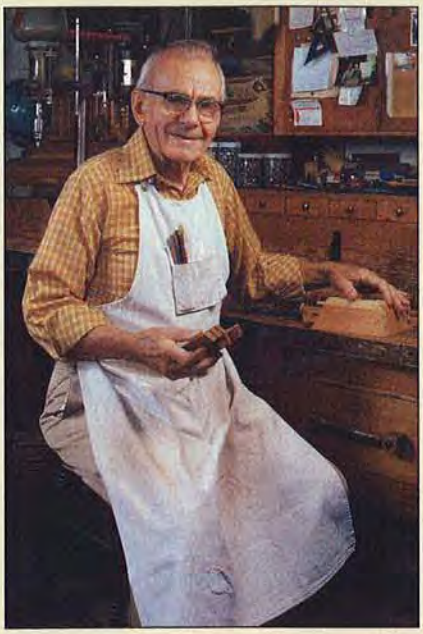
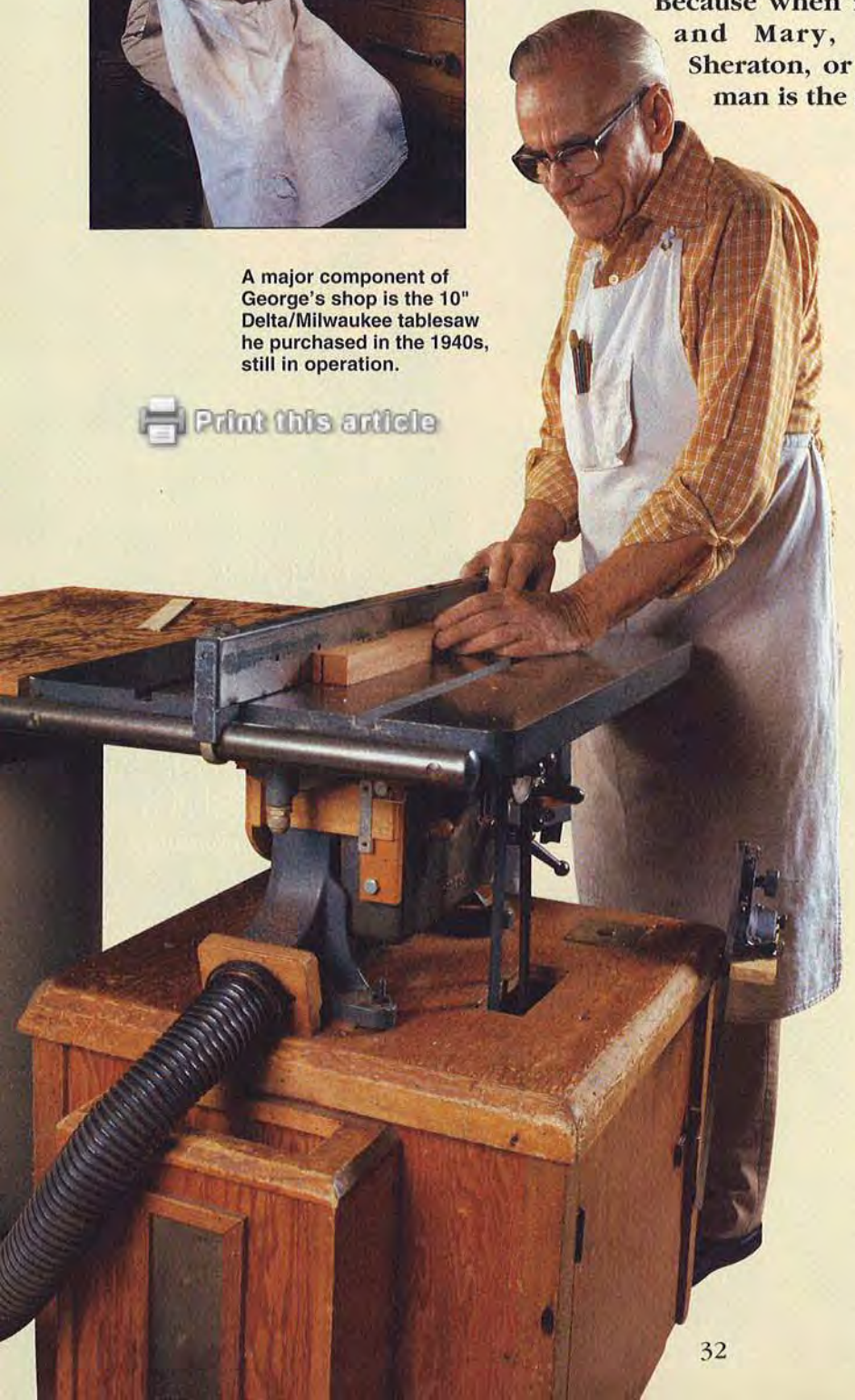
Building reproductions of classic furniture requires the ability to carve. At his bench, George works on a mahogany shell decoration that's essential to Chippendale.



Left: At 81, George Reid still spends his days in the workshop. Sometimes he builds reproduction furniture, other times he works on aging classics that have been brought in for repair.

Wilbur and Orville Wright tinkered their way into aviation history from their bicycle shop in Dayton, Ohio. George Reid, a fellow Daytonian, probably won't earn a spot in any history book, yet for over 50 years, that city's most prominent families have turned to him for finely crafted heirloom furniture. Because when it comes to the classics—William and Mary, Queen Anne, Chippendale, Sheraton, or Hepplewhite—this master craftsman is the authority.



A major component of George's shop is the 10" Delta/Milwaukee tablesaw he purchased in the 1940s, still in operation.

Print this article

George went on his own as a full-time woodworker in 1947. Before that, he had worked as a clerk in an accounting office and, during WWII, as a civilian modelmaker with the Training Film Laboratory at Dayton's Wright Field. There, he put his skills to use building props and models for training films.

"When the war came to an end, I knew the laboratory would be phasing out the civilians—I'd have to do something," says George. He stops work at his tablesaw, folds his arms comfortably, and continues. "I owned a few tools and was doing some outside work, nothing fancy, on weekends and evenings. For instance, I had picked up some work from the American Optical Co. making wooden lens cases for opticians' testing machines. In February 1947, I set up shop for full-time woodworking in the basement of our house."

A year went by before George fully tooled up. Then, he bought all the power equipment he thought he'd ever need. (With only a minor exception, those tools are the ones he still uses today!) They include: a Delta/Milwaukee 10" tilting-top tablesaw, a Sears bandsaw and lathe (they came with a bright blue finish at the time), a Delta 2-hp shaper with a host of cutters, a Boice-Crane planer, and a Delta 24" bandsaw. Those power tools joined a 1939 Delta drill press that he had acquired earlier. But like many of us, George underestimated his needs, and in 1952 paid out $156 for a heavy-duty

jigsaw—the last power tool he's ever bought.

Of course, George added hand tools as he needed them. In that category, his best buy came in the early fifties. "I'd heard about some English-made carving tools for sale by the son of one of the master carvers at the old Dayton Carworks," George remembers. "As it happened, there were 287 of them, most made by Addis. They're the finest I've ever used."

A career takes off in the post-war boom

From the first, George was confident that he could make it on his own. As it turned out, though, he did get a little help from a friend.

"A designer whom I had worked with at Wright Field went to work for Dayton's finest department store. He was in charge of their floor planning," George recalls. "All businesses then were trying to expand and serve the new post-war buying public. And I got a lot of work building store fixtures—millinery counters, cabinets, showcases, book displays, and that type of thing."

Indeed, George's woodworking career was shaped by the consumer demand of the times. In the early 1950s, for instance, hi-fi sound systems were growing popular, but according to George, there wasn't cabinetry available to house the components. Opportunity knocked, and the craftsman was sought by several stores to plug the gap.

"Of course, people started wanting hi-fi cabinets to blend with their furniture," George notes. "As a result, I got into some very good homes." He was prepared, too. George had always admired classical furniture styles and had studied them diligently, even taking trips East to visit various museum collections.

Eventually, however, cabinet manufacturers caught up, and by the late 1950s George's hi-fi cabinet commissions were dwindling. In the meantime, his list of prestigious private clients willing to pay for quality, custom-made classic furniture had grown. His skilled hands began satisfying their often unique and always pricey decorating needs. He fondly recalls examples.

"This one family wanted a very special, Sheraton-style dining table," George points out as he turns the pages of his scrapbook. "I built it of mahogany with an accordion-type folding mechanism [see photo *below left*] that allowed it to expand to 12½'."

Another of George's favorites is the Chippendale chest-on-chest, shown *below*. "It was built to store silver flatware," says the maker. "I scaled it down to about one-half the size of a full-sized chest-on-chest and faced the drawers with book-matched, figured black walnut veneer."

While George worked at commissioned pieces like those in the daytime, he spent evenings build-

Continued

Right: **George scaled down this walnut Chippendale chest-on-chest to half-size in order to accommodate a customer's large collection of silverware.**

Below: **George hand-carved the detailed water-leaf motif on the lyre-shaped legs of this Sheraton-style, mahogany dining table he built.**

Left: **This reproduction of a 1770 Newport-style shell desk was built as part of George's living "showroom."**

Near left: **Showcase pieces in George and Pauline's living room include the cherry Chippendale drop-front desk and the mahogany-framed Sheraton sofa with curly elm inlay.**

ing furniture for their home, as shown in the photos *above*. "Of course, I made the furniture for us to use, but I also wanted it for a bit of display," says George, his eyes twinkling. "Customers could see my work and pick out the style for a piece—somewhat like a furniture showroom."

Today, George laments that with the passing of time—and money into younger hands—the call for the classic furniture that he made into a speciality just isn't what it used to be. "The money generation now must have different tastes," he speculates.

Expertise covered by a million bucks

George admits to carrying a million dollars' in liability insurance, "Just in case I go into a house and something gets damaged." Yet, in all this time, that has only happened once.

"It was a steady customer of mine," explains the craftsman from a seat at his workbench. "She had a corner cabinet that held her collection of porcelain pieces, all on glass shelving. And she wanted a lock put on it. I had to work in her home. Before I came, she had taken everything out except what was on the very top shelf.

"She was busy in the kitchen when I got done with the lock," George recalls. "I closed the cabinet door, locked it, and turned to walk away when there was this most awful noise as the top shelf came down. I went to the kitchen and said, 'There's a terrible thing happened in here, ma'am.'"

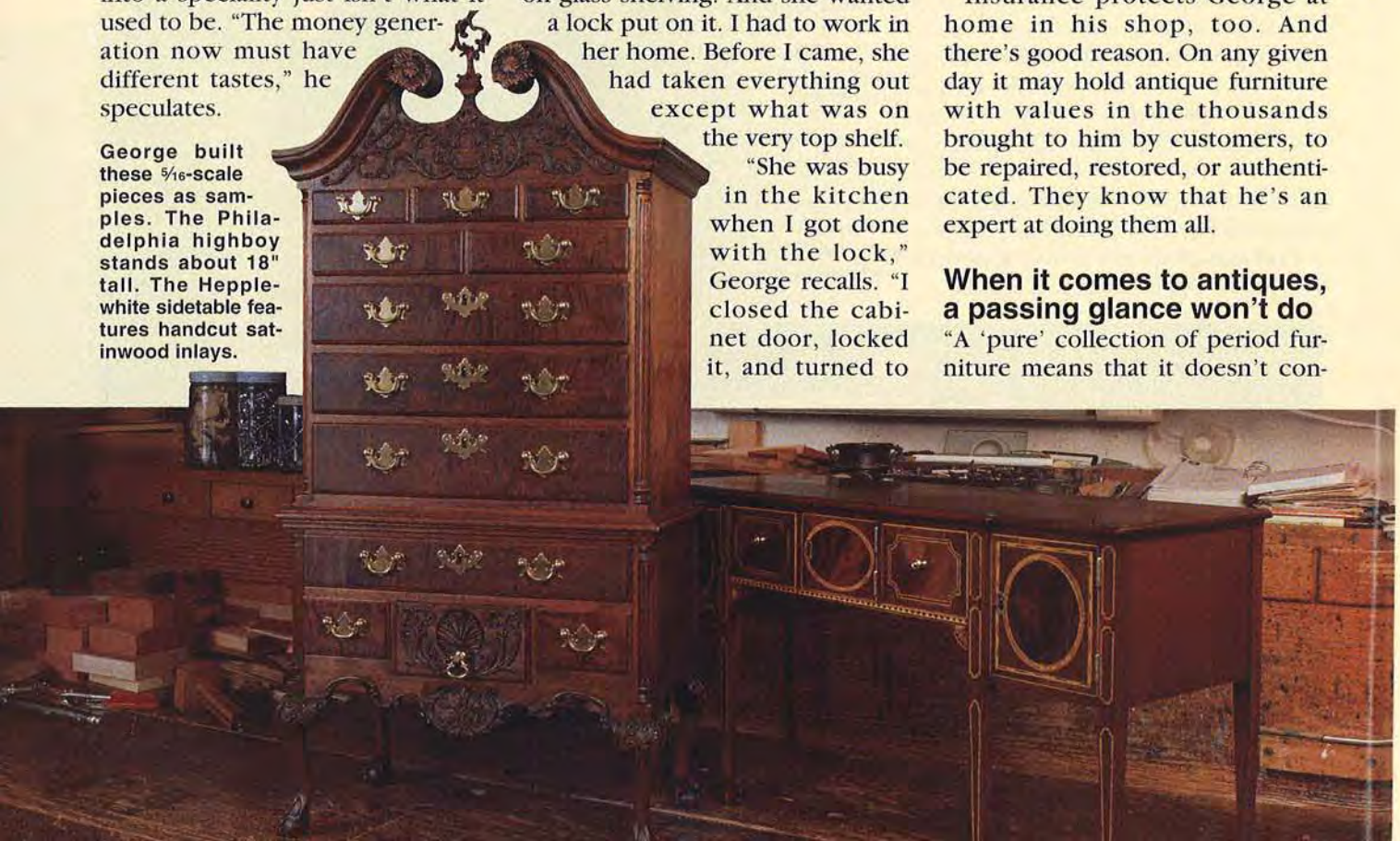
George never did have to file an insurance claim, though. His customer graciously apologized for having "collected too many things," and told him that dealing with the insurance company would have been "such a bother" for each of them. And that was it.

Insurance protects George at home in his shop, too. And there's good reason. On any given day it may hold antique furniture with values in the thousands brought to him by customers, to be repaired, restored, or authenticated. They know that he's an expert at doing them all.

When it comes to antiques, a passing glance won't do

"A 'pure' collection of period furniture means that it doesn't con-

George built these 5/16-scale pieces as samples. The Philadelphia highboy stands about 18" tall. The Hepplewhite sidetable features handcut satinwood inlays.



Right: **"Pointed dovetails indicate English craftsmanship," says George. The 1780-vintage Queen Anne lowboy behind him was brought in for repair.**

tain pieces that have been altered," George explains in describing Yale University's Garvan Collection. "It's about the purest assembly of furniture I know of because Mr. Garvan wouldn't buy a piece unless he had his old-time cabinetmaker go over it completely."

To mark the importance of that, George tells of the time he was called on to repair an American Chippendale-style blockfront desk said to be from the 1770s. "I worked on that piece for two weeks and just felt that something wasn't right," he remembers. "Finally, I removed the base molding to get to the feet. As soon as I got the molding off, the story of the piece opened like a book. I saw all the new work. The same mahogany stock as the original, but it was definitely a straight-front desk made into a blockfront.

"That's why it's impossible just to give a piece a glance, or pull a drawer out to inspect [see photo *above right*] in order to determine its history," he continues. "There are few pieces that haven't had something done to them. And that's okay, but they shouldn't be represented as originals."

Fakes are another story. "A customer brought an American Queen Anne lowboy to me that supposedly was from the early 1700s," George says. "He had bought it from a reputable antique dealer, but he had some doubts. I didn't think it looked bad, but after I got into it, in no time at all I found out that it was totally fake. You see, the end panels were supposed to be mortised and tenoned into the legs, but they were all doweled. That didn't come along until the 1780s or so. He got his money back.

"There was an awful lot of fakery that went on after WWI," George goes on. "Wealthy Americans sent decorators to Europe to buy furniture. Those boys over there were waiting for them. They'd just have parts of some old pieces, and so they would finish them out using old wood, which they had plenty of, then stain and coat the new work to match. And those craftsmen really had the skills. That's why you can't make a judgement on a piece without actually going through it almost piece by piece."

What about maker's marks, dates, and signatures to help with authentication? "Lots of people think so," George replies, "but in fact I seldom find any such thing. The English, for instance, never put marks on their furniture, whereas the French, and some Americans, left initials or a date, at least to tell you that they did something significant."

This craftsman, though, who has produced nothing but the finest of furniture, erases any future doubt concerning their origin. Somewhere, each is indelibly marked MADE BY GEORGE REID and dated.

Woodworking wisdom from 50 years on the job

With his experience, George could fill volumes with observations, advice, tips, techniques, and finishing tricks. Here's a random selection he offered:

- "There are so many ways to finish, and none of them is the perfect one for me because each piece of furniture requires a different approach."
- "Most of the time, I use two coats of 3-pound cut orange shellac thinned 50/50 with denatured alcohol for a sealer. Then I come back with lacquer or varnish or whatever."
- "If I'm going to fill open-grain wood, I always fill it with a color darker than the natural."
- "I stain mahogany without discoloring any lighter inlay by mixing potassium dichromate crystals with luke-warm water and then put that on the raw wood. It won't attack the inlay like a pigmented stain. Next, I apply a thin coat of orange shellac for sealer."
- "Museums want you to use hide glue on furniture for the reversibility of it. But hide glue grows [gives] with moisture. I've always used Titebond."
- "You can darken cherry by putting it outside in the sun, but you have to turn it regularly to keep it even."
- "There's no way to repair a finish so that it can't be seen unless you redo it all."
- "I clean up an old, but solid finish with furniture refinisher, then rub on lemon oil and buff it. You've got to match the patina of the old."
- "I normally fix a bowed top by making a saw kerf on the side away from the bow, if it's the underside, then glue in a wedge of the same wood. Then, I sand it down and finish it."
- On building classic furniture: "You've got to study. I have volumes on the styles, and lots of books with measured drawings. Then, you have to see it. Once you understand the proportions and features of the different styles, you can scale up or down from there."

Written by Peter J. Stephano Photographs: Martin Beil; George Reid collection

Country-style KITCHEN TABLE

Breadboard ends, a rock-solid top, turned legs, and a terrific paint job all add up to one fine dining experience. Built to take the rigors of family meals day in and day out, this project will be around for years. Oh, and don't worry if you're not a turner. See our source for preturned legs in the Buying Guide. If the painted base doesn't suit your decorating tastes, leave it unpainted or consider an oak base and tabletop.

Let's edge-join boards to form the table

1 From 1 1/16"-thick stock (commonly called five-quarter stock), rip seven straight boards approximately 5½" wide each to form the edge-joined tabletop (A) and two boards 5" wide each for the breadboard ends (B). Breadboard ends are a traditional tongue-and-groove method for capping the ends of projects using edge-joined solid stock. With the grain of the ends (B) running perpendicular to the tabletop (A), the ends help keep the tabletop flat.

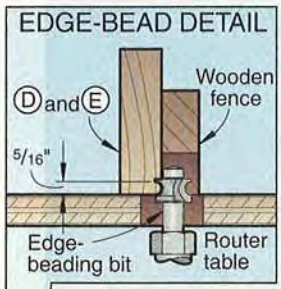
2 Crosscut the maple tabletop boards 2" longer than listed in the Bill of Materials.

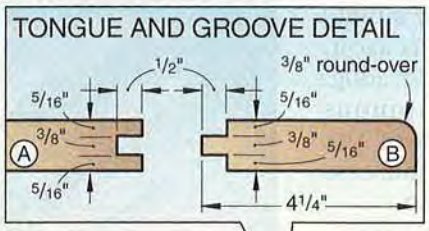
3 Joint one edge of each board. Rip the *opposite edge* of each of the seven tabletop (A) boards to 5¼" wide, and joint the cut edge. Rip the breadboard ends (B) to 1/32" over width, and joint the ripped edge to final width (4¼").

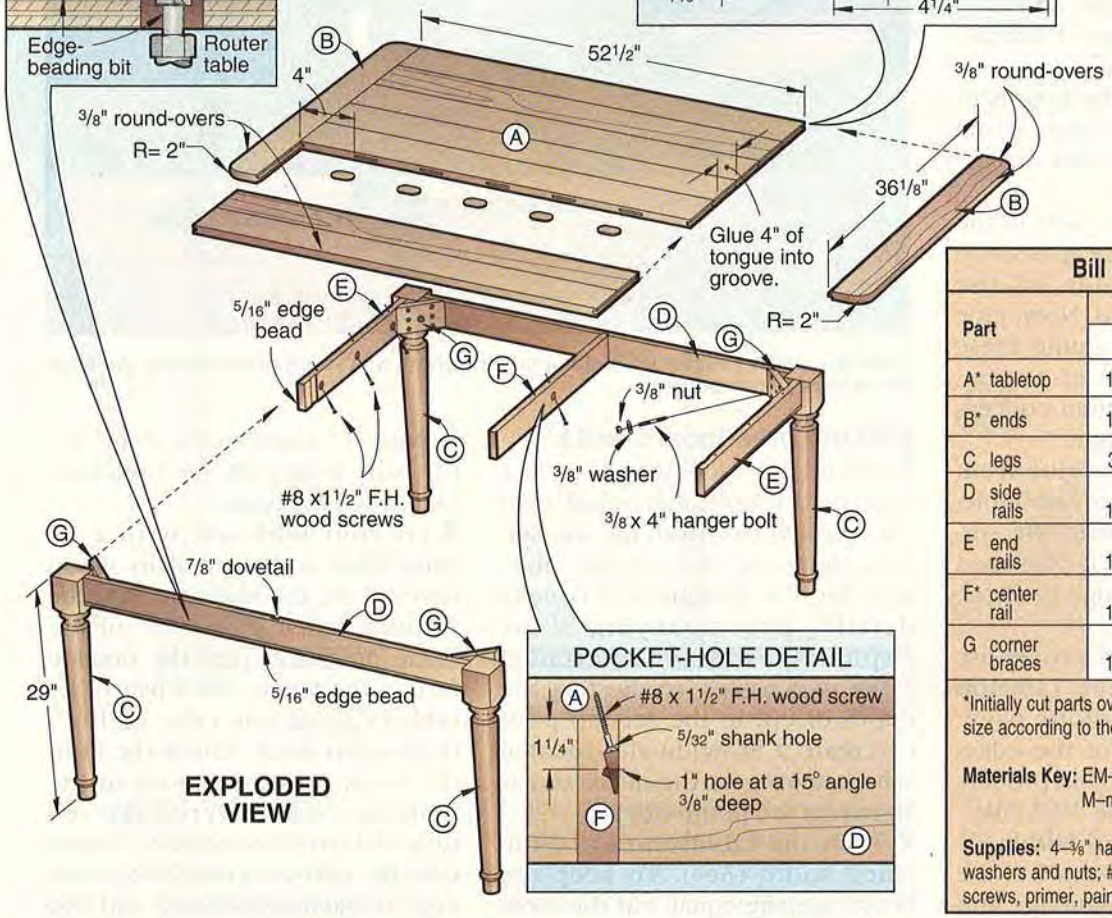
4 Lay out the boards for the tabletop (A) on your workbench to get the best grain match. Then, mark the order on the ends of the boards, for positioning them in the same configuration later.

5 Separate the tabletop boards into pairs of adjacent boards (there will be one extra), and mark each pair for biscuit or short splines. Start 4" in from the ends, and cut slots for five biscuits. If you don't have a biscuit joiner, a

Continued







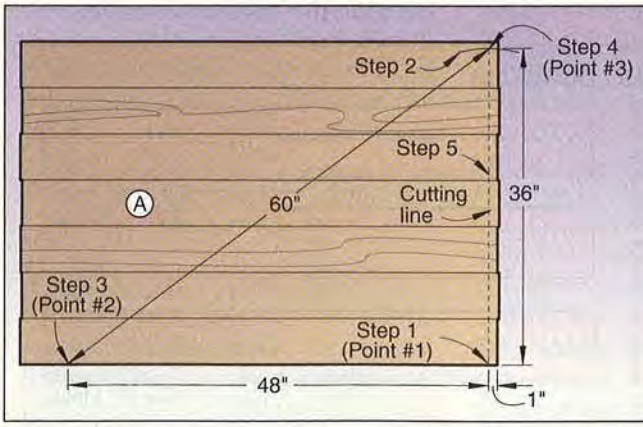
Bill of Materials

Part	Finished Size T	W	L	Matl.	Qty.
A* tabletop	1 1/16"	36"	52 1/2"	EM	1
B* ends	1 1/16"	4 1/4"	36 1/8"	M	2
C legs	3 1/2"	3 1/2"	29"	LM	4
D side rails	1 1/16"	3 1/2"	50"	M	2
E end rails	1 1/16"	3 1/2"	26"	M	2
F* center rail	1 1/16"	3 1/2"	29 1/4"	M	1
G corner braces	1 1/16"	3 1/2"	6 1/4"	M	4

*Initially cut parts oversized. Then, trim to finish size according to the how-to instructions.

Materials Key: EM–edge-joined maple, M–maple, LM–laminated maple.

Supplies: 4–3/8" hanger bolts 4" long with flat washers and nuts; #8 x1 1/2" flathead wood screws, primer, paint, and clear finish.



SQUARING-UP THE TABLETOP

STEP 1
Make a pencil mark (Point #1), 1" from the corner of the tabletop.

STEP 2
Use a trammel point to mark a short arc 36" from Point #1 on the same end of the tabletop.

STEP 3
From Point #1, measure and make a mark 48" away (Point #2) along the edge of the tabletop.

STEP 4
From Point #2, measure exactly 60" diagonally to the arc and make a mark (Point #3) at the intersection on the arc.

STEP 5
Draw a line from Point #1 to Point #3. This line will be square to the edge (Point #1 to Point #2). This method will compensate for a side not being perfectly straight and works better than using a carpenter's square.

router with a slotting cutter and shop-made splines will work. Since the purpose of the biscuits or splines is alignment and not strength, they should fit snugly into the slots. For this reason, make the splines about 1½" long. Do not make one continuous spline the entire length of the boards; this will greatly increase the difficulty of the glue-up.

6 Edge-glue each pair of boards. Use scrap strips of wood between the clamp jaws and the boards to protect the jointed edges. When the glue squeeze-out turns gummy, scrape it off.

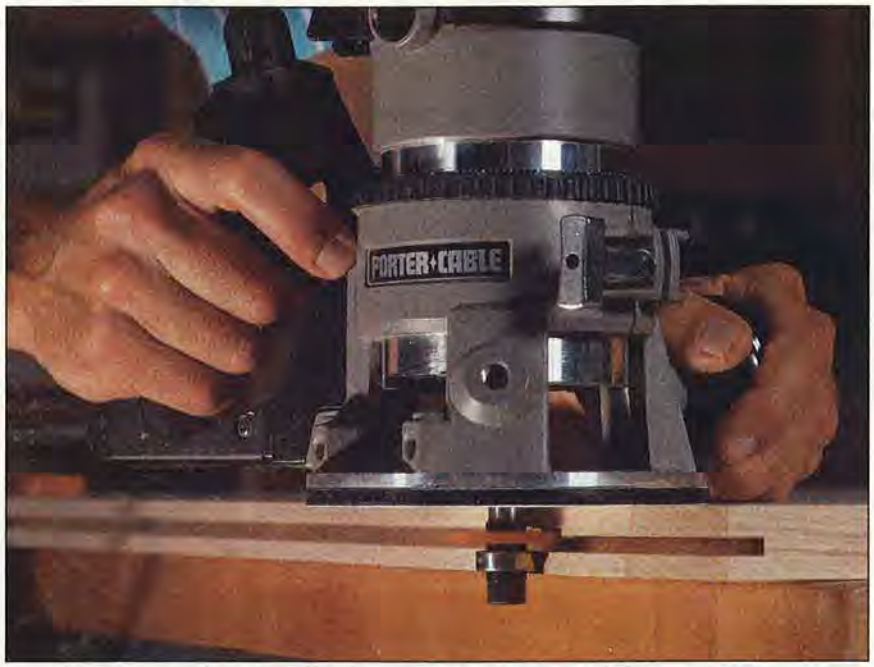
7 Cut biscuit or spline slots in the mating edges of the glued-up boards and one edge of the remaining single board. Now, glue the top together by gluing these four pieces one pair at a time. This allows for maximum concentration on each glue joint.

8 Remove the excess glue from the top and bottom of the tabletop. Hand-plane or sand the surfaces smooth and level. (We used a long metal straightedge to check for level surfaces.)

9 Using the five-step procedure on the Squaring-Up the Tabletop drawing on the *previous* page, square up the ends of the edge-joined tabletop (A). This process is commonly called the 3-4-5 rule.

10 Using a jigsaw, cut within ⅛" of the line marked in Step 5 of the drawing. With a straightedge and a router, run the router's base against the straightedge to rout to the line. A spiral-flute bit will give the best results when routing end grain.

11 Measure 52½" from the routed end of the tabletop to the opposite end. Lay out the cutline on that end. Use a jigsaw and router to trim the end, using the same procedure noted in Step 10.



Make two passes with a ¼" slotting cutter to form a ⅜"-wide groove along the ends of the edge-joined tabletop.

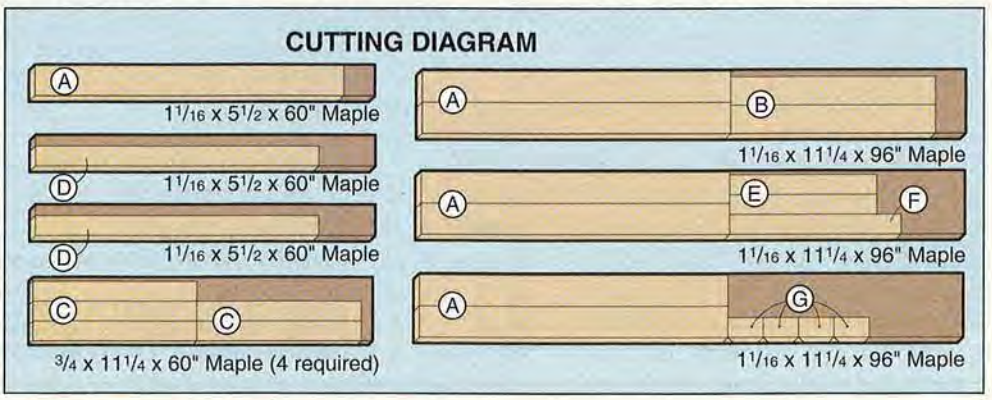
Add the breadboard ends

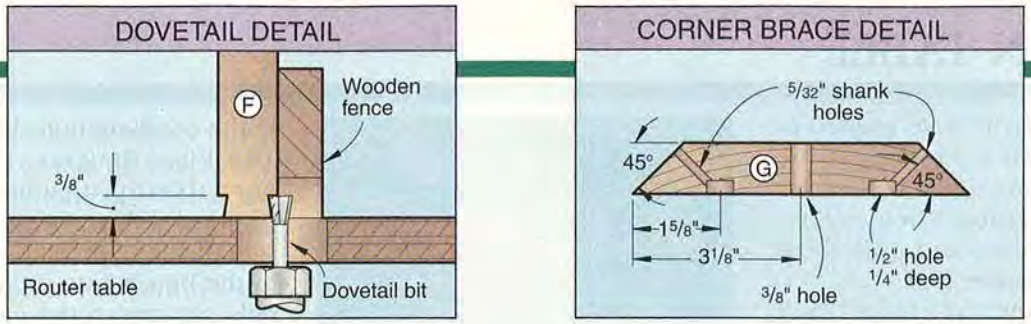
1 Install a ¼" slot-cutting bit in a hand-held router, and adjust it to cut a groove 5/16" from the top surface along the ends of the tabletop. See the Tongue and Groove detail accompanying the Exploded View for reference. Make two passes, readjusting the depth of cut in the second pass, to create a ⅜"-wide slot located where shown on the detail and as shown in the photo *above*.

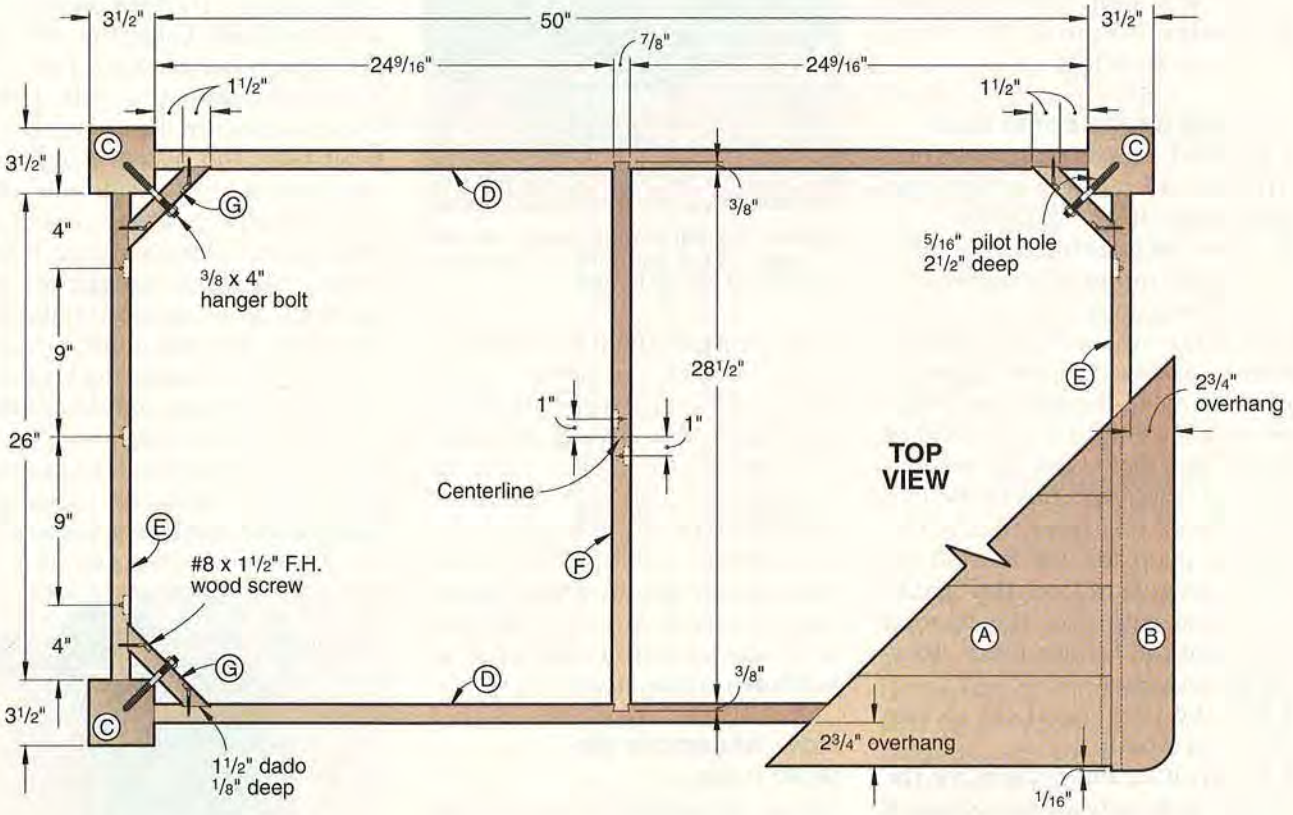
2 Trim the tabletop (A) to finished width (36"). To keep the board spacing equal, cut the same amount off each edge.

3 Rout ⅜" round-overs along the top side edges of the tabletop. *Don't rout the ends.*

4 Fit your tablesaw with a ⅝" dado blade and an auxiliary wood fence. Raise the blade 5/16" into the wooden fence so that ½" of the blade protrudes past the outside face of the fence. Cut a pair of ½" rabbets along one edge of 1 1/16"-thick scrap stock. Check the fit of the stock into the groove in the tabletop ends to verify the setting. Adjust if necessary. Then, cut the rabbets along the inner edge of each breadboard end. Do not glue the ends in place yet.







5 Carefully measure the width of your tabletop and crosscut the breadboard ends to this length *plus 1/8"*. The extra length allows the laminated tabletop (A) to expand without moving past the ends of the breadboard ends.

6 Mark and cut a 2" radius on the outside corners of the breadboard ends. Sand the ends.

7 Rout a 3/8" round-over along the *top outside* edges on the breadboard ends.

8 Sand a slight round-over on the corners of the tongue. This eliminates a sharp edge on the tongue that will stick out beyond the outside edge of the tabletop.

9 Join the breadboard ends to the ends of the edge-glued tabletop by gluing *only the center 4"* of the breadboard ends to the *center 4"* of the ends of the tabletop. The rest is left unglued, allowing the two mating pieces (A and B) to expand and contract independently of each other. If you glue along the entire joint, the tabletop—which expands and contracts greater across the grain than the breadboard ends do with the grain—can cause the tabletop to split at its weakest point.

10 Using a finish sander and 100- or 120-grit sandpaper, sand the tabletop top smooth.

Turn four legs for a sturdy base

1 To get the legs for this table, you can either turn your own or order preturned legs from the source listed in the Buying Guide. If you make your own, laminate stock to form legs measuring 3½" square after final machining. Then, refer to the article beginning on *page 42* to see how to turn the legs to shape.

2 Cradle the top portion of each leg in a V-block jig on your drill-press table. Drill a 5/16" pilot hole 2½" deep and 1¾" from the top end into the inside corner of each leg. (After marking the corner of

Continued

the leg where the hole needed to be, we sanded a flat area at the mark, providing a flat surface for the bit to go into. Then, we re-marked the point and drilled the hole for the hanger bolt.)

3 Double-nut a ⅜×4" hanger bolt and thread it into the hole in one of the legs until 1½" of the bolt protrudes. Remove the nuts. Repeat for each leg.

The apron rails come next

1 Rip and crosscut the side rails (D) and end rails (E) to the sizes listed in the Bill of Materials.

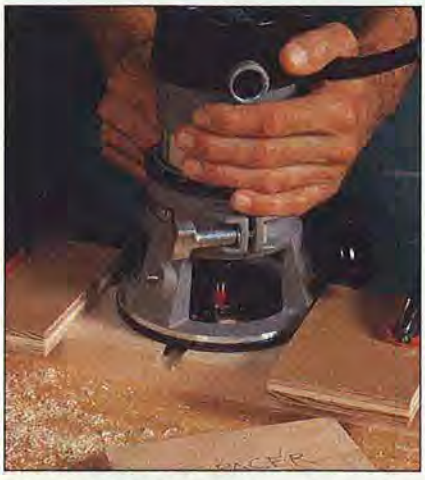
2 Mount an edge-beading bit into your table-mounted router, and rout a bead along the bottom outside edge of each rail where shown on the Edge-Bead detail accompanying the Exploded View drawing. (We used a Freud 80-122 router bit.) Hand-sand the bead.

3 For housing the ends of the corner braces (G) later, cut a 1½" dado ⅛" deep and 1½" in from the ends of each rail on the inside face (that opposite the beaded face). See the Corner Brace drawing for reference.

4 Cut the center rail (F) to size plus 1" in length.

5 For creating the pockets for the pocket hole screws for connecting the tabletop to the rails (E, F) later, chuck a 1" Forstner bit into your drill press, and drill a hole 1¼" from the top edge on the *inside face* of each rail (E, F) at a 15° angle where shown on the Pocket-Hole detail accompanying the Exploded View drawing. Then, drill a 5⁄32" shank hole through the top inside corner of each 1" hole where shown.

6 Mark a line across each side rail (D), centering the line between the ends. Cut a ½" dado 5⁄16" deep across the side rails, centered over the marked line. The dado removes most of the material, making it easier to cut the dovetail in the next step.



Rout a dovetail slot centered over the ½" dado in the end rails for capturing the ends of the center rail.

7 Fit your hand-held router with a ½" dovetail bit, and adjust it to cut ⅜" deep. Using stops to determine the width of your cut, make two passes to rout a ⅞"-wide dovetail slot centered over the ½" dado just cut. To determine how far apart to position the stops, measure the width of your router base and add ⅜". (We test-cut scrap stock first to verify the spacing between the stops.)

Now, assemble the table base

1 Cut the corner braces (G) to size, miter-cutting the ends of each brace at 45°.

2 Drill six ½" holes ¼" deep in each piece where shown on the Corner Brace drawing and the Corner Brace detail accompanying the Top View drawing. Drill a 5⁄32" hole centered through each ½" hole at a 45° angle where shown on the detail. (To do this, we placed the beveled end of the corner brace flat on our drill-press table, automatically positioning the bit at a 45° angle to the ½" holes.) Now, drill a ⅜" hole through each corner brace where shown on the drawing and detail.

3 Place the side and end rails (D, E) and braces (G) on a flat surface in the configuration shown on the Top View drawing. (We placed our tabletop upside down and positioned the rails on the bottom side of the tabletop.) Fit the ends of the braces into the dado in the rails. Square-up the entire assembly, and check that the edges that will be the top of the table base later are flush. Using the holes in the braces as guides, drill 7⁄64" pilot holes into the rails. Drive screws to secure the assembly.

4 Measure the distance between the dovetails in the side rails (D), and cut the center rail (F) to length. Cut a dovetail on each end of the rail where shown on the Dovetail detail accompanying the Top View drawing. Rout dovetails on the ends of scrap stock first to verify the setting before routing the ends of the center rail.

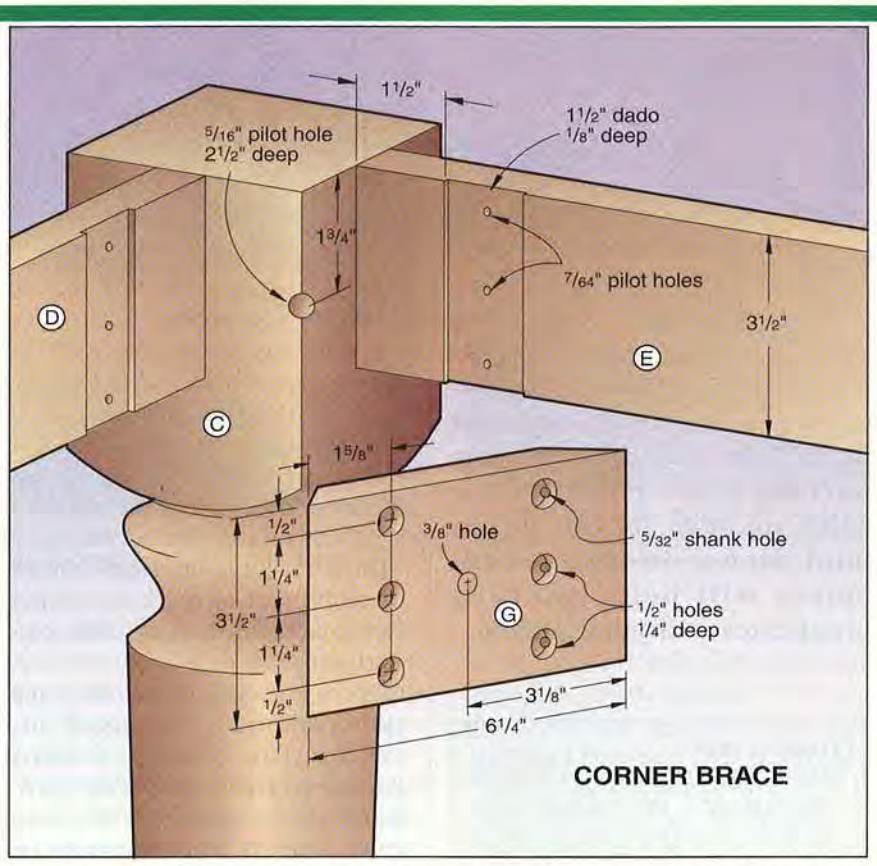
5 Glue the center rail (F) in place between the side apron rails (D), making sure the holes in the center rail are oriented correctly.

6 Place the tabletop upside down on a blanket or pad on your workbench or sawhorses. Position the apron assembly (also upside down) on the tabletop. Fit the legs (C) into place, sliding the hanger bolt protruding from each leg through the mating hole in each corner brace. Use a washer and nut at each corner brace to draw the legs tightly against the ends of the apron rails.

7 Center the base on the tabletop. Again, check for square and an even overhang. Drill pilot holes, and drive screws through the previously drilled mounting holes in the rails (E, F) to secure the base to the tabletop as shown in the photo *below*.

8 Make an index mark on the inside face of one side rail (D) and that edge of the tabletop next to it. The marks will allow you to reassemble the table in the same configuration later, aligning the mounting holes.

Drive screws through the mounting holes in the apron rails to secure the base to the tabletop.



Finishing and final assembly

1 Unbolt the legs from the assembly. Sand the tabletop, legs, and apron assembly with a 120-220-320 grit progression.

2 Apply finish to the entire tabletop (top and bottom), the back side and beaded surface of the apron rails (not the area above the bead, you'll paint this later). We used Minwax Fast-Drying Polyurethane, sanding between coats with 320-grit sandpaper. If you get any finish on the front surface of the aprons (the area above the bead) sand it off now.

3 Mask the bead and back surface of the apron assembly with tape and paper. Mask the exposed threads of the hanger bolts threaded into the legs. Prime the legs and apron assembly (we used Krylon Sandable Primer #1315 All-Purpose Primer White). Sand lightly with 320-grit sandpaper after the primer has dried. Paint the primed areas (we used Rust-Oleum American Accents Heritage Satin Finish Teal 7929). Let the apron assembly dry and remove the masking. (For more information on professional-looking spray painting, see the article on *page 29* for our method.)

4 Let the project dry (and the paint harden) for a couple of days. Put a pad or blanket on the kitchen floor and place the tabletop on it upside down. Align the index mark on the apron assembly with that marked on the bottom side of the tabletop earlier. Screw the two assemblies together. Bolt the legs in place, turn the table over, add place settings, and have lunch.

Buying Guide

Turned legs. Four legs, catalog no. A0901-29, $115 ppd. for maple, $122 ppd. for oak. Adams Wood Products, 974 Forest Drive, Morristown, TN 37814. Or call 423-587-2942 to order.

Written by Marlen Kemmet Project Design: Jan Hale Svec Illustrations: Lorna Johnson Photographs: Hopkins Associates; Hetherington Photography

Make 'em match

Print this article

HOW TO TURN LOOK-ALIKE LEGS

Turning four matching legs stands as a daunting task in many a woodworker's mind. But don't let that fear keep you from turning legs for the kitchen table on *page 36*. Our layout and dimensioning procedures will help you turn duplicates without distress.

Project prep

Stock: Each leg calls for a blank 3½×3½×31". For painted legs, laminated birch or poplar would be good choices. Clear-finished legs should be from solid stock.

Lathe equipment: Spur drive center, live (rotating) tail center.

Turning tools:
¾" or 1¼" roughing gouge
⅜" and ½" spindle gouge
1" skew, 3/16" parting tool

Lathe speeds:
Roughing: 500–800 rpm
Finish-turning: 1000–1200 rpm

Prepare the stock

For each leg, dress a piece of laminated or solid stock at least 31" long to 3½×3½". Be sure that all four faces meet at 90° angles. Trim the stock to 31" long. (Since our legs would be painted, we laminated 1"-thick birch for our blanks.)

Draw diagonal lines on each end of each piece to mark the centers. Designate one end of each piece as the top.

On one piece, draw three lines across one face—one line 1" from the top (Line A on the Full-Sized Pattern in the *WOOD PATTERNS*® insert in the middle of the magazine), one 5" from the top (Line B), and another 5½" down (Line C). Using a try square, transfer the lines to the blank's other three faces. Then, transfer the lines from that piece to the other pieces of stock to ensure uniformity.

Install a spur center in your lathe's headstock and a revolving (live) center at the tailstock. Mount the workpiece between centers, placing the top of the leg at the headstock.

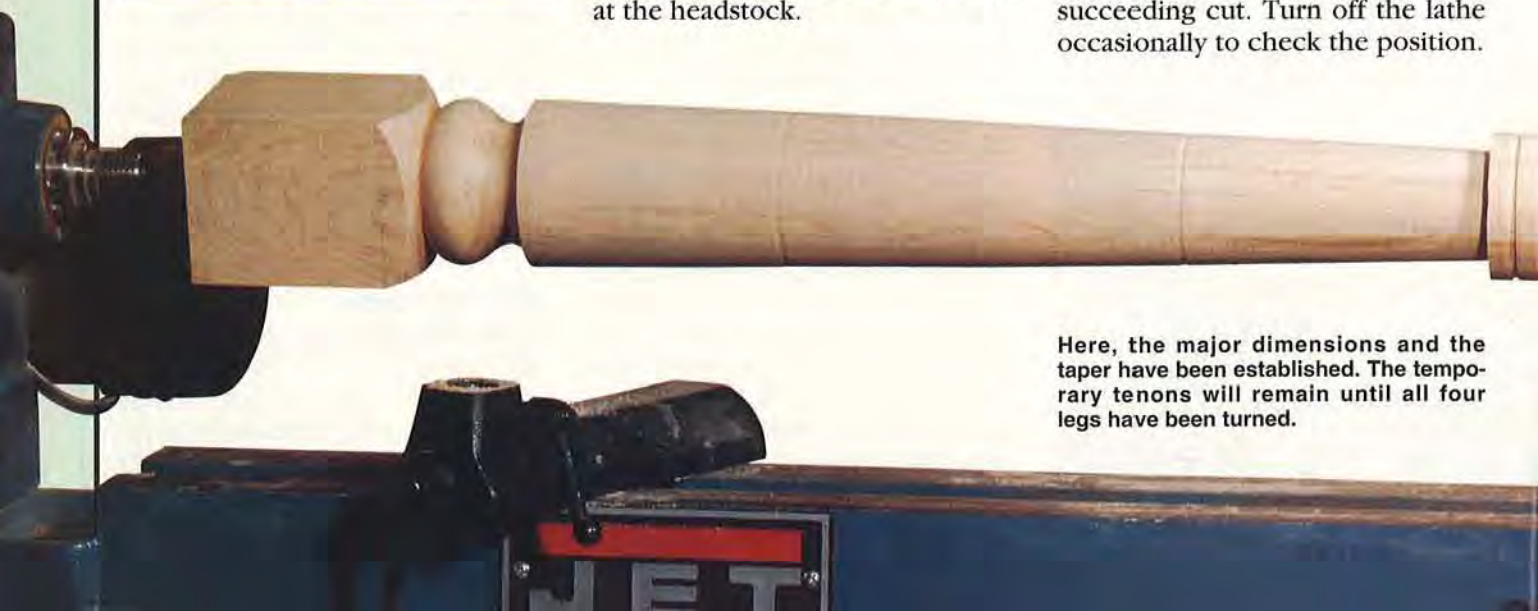
Rough out the leg

Starting from the tailstock end, round down the workpiece to its maximum diameter, about 3½". Note the actual diameter so you can later turn each of the other blanks to the same size. Round the stock to within ¾" below Line C. A ¾" or 1¼" roughing gouge does the job quickly.

Next, form the transition where the leg changes from square to round. The transition occurs between Lines B and C, as shown on the pattern. Taking light cuts with a ½" gouge, work from Line B down to Line C, cutting inward. From Line C, cut straight down to the rounded part of the turning.

SEE THE *WOOD PATTERNS*® INSERT FOR FULL-SIZED PATTERNS

The corner points of the curved transition line should just touch Line B at the corners of the stock. So, start slightly below Line B, and move back toward it with each succeeding cut. Turn off the lathe occasionally to check the position.



Here, the major dimensions and the taper have been established. The temporary tenons will remain until all four legs have been turned.

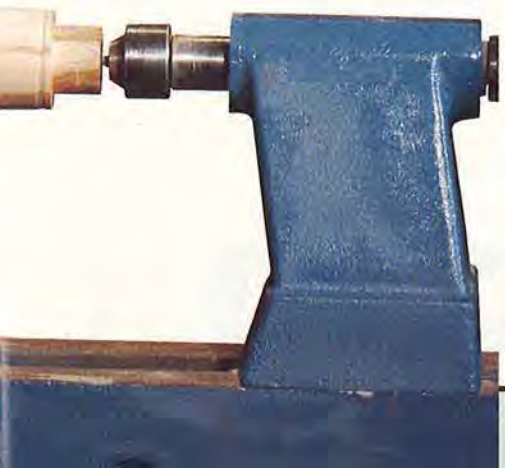
Accurate sizing cuts ensure that the turned legs will be uniform. Carefully set the caliper for each cut, and don't force it over the turning; wait until it falls freely.

The groove in the middle of the lower bead is the sizing cut which establishes the finished diameter for the feature.

Next, turn away the 1" waste section at the top of the leg, leaving a tenon to support the turning. This establishes the finished top of the leg. To remove the waste and form the tenon, make repeated light cuts from the outside toward the drive center, using your ½" gouge rolled on its side. Leave a tenon about 1⅜" in diameter. Cut to the dimension line, but leave it visible on the faces.

Lay out the features

Refer to the Full-Sized pattern, and draw Lines E–N on the leg. Here's how. Measuring from the finished top of the leg, place a pencil mark at the distance shown for each line. Then, with the lathe running, hold a pencil against the turning at each mark to draw the lines.



At each line, cut in to the specified diameter with a parting tool. These dimensioning cuts will help you place and shape each leg's details accurately.

To make a dimensioning cut, first set an outside caliper to the diameter shown for the particular line. Then, cut straight into the workpiece with a parting tool. While cutting, hold the caliper above and behind the turning, letting it rest lightly in the parting-tool cut as shown *above*. When the caliper slips down over the turning, you have reached the specified diameter. Cut in at every line this way. Be careful as you gauge the cuts; the caliper can catch in the groove. Grip the caliper gingerly as shown. This way if it does catch, it will pull from your grip without hurting your fingers.

Center the cuts for beads and coves on the line. On the tapered section, cut below the line to prevent cutting into the larger portion above the line. Cut on the outside of lines such as J and L, which mark the width of a feature. For that feature, cut Line J with the parting tool on the headstock side of the line, Line L with it on the tailstock side.

Shape the leg

With the dimensioning cuts completed, form the details. Starting at the top of the leg, shape the cove and bead between Lines C and G.

Next, establish the diameter at G, then taper the leg from there to Line J. Shape the taper to about 1/16" above the dimensioning cuts. Check the taper with a straightedge, refining it as necessary.

Then, form the leg's lower end. Starting at Line N, cut a tenon on the bottom of the leg as on top. Shape the leg from Line L to the bottom. At this point, the leg should look like the one *left*.

Finish-turn the taper, using a sharp gouge or large skew. Turn the lower bead with a gouge or skew, as shown *above*, then finish the lower taper. Form the chamfer on the bottom. Lightly sand the leg, and turn the supporting tenons to about 1" diameter. Don't part them off yet.

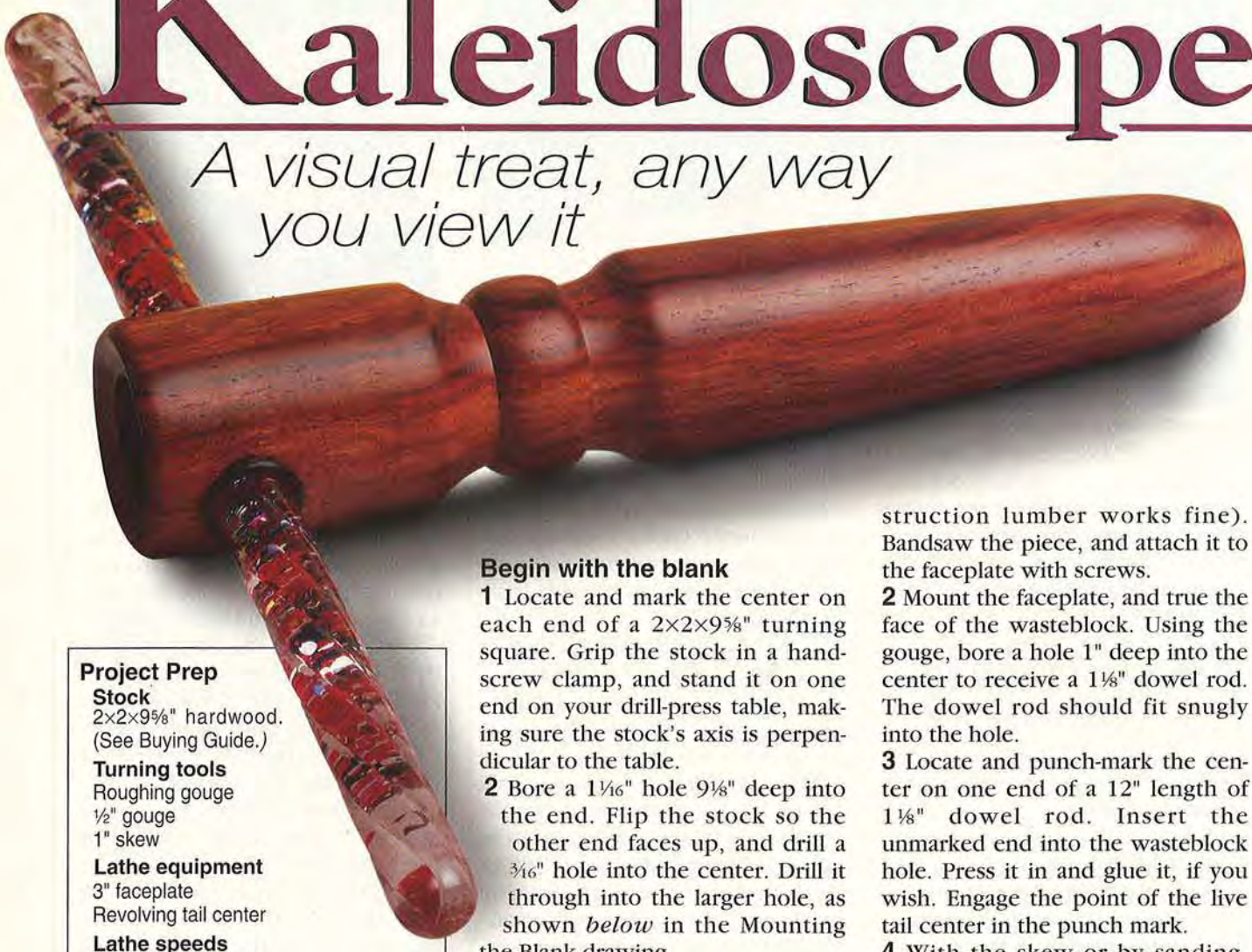
Dismount the completed leg. Completely turn all four legs following the same layout and dimensioning steps, but don't remove the tenons from any of them. After completing all four, compare them. When you're satisfied that they match, part off the tenons.

Illustration: Lorna Johnson Photographs: John Hetherington

ONE COOL Kaleidoscope

Print this article

A visual treat, any way you view it



Project Prep

Stock
2×2×9⅝" hardwood. (See Buying Guide.)

Turning tools
Roughing gouge
½" gouge
1" skew

Lathe equipment
3" faceplate
Revolving tail center

Lathe speeds
Roughing: 800–1000 rpm
Turning: 1500–1800 rpm
Finishing: 1800–2000 rpm

Buying Guide

Predrilled blank. 2×2×9⅝" blank with 1 1/16", 3/16", and ⅝" holes drilled. Bocote (WN400), $12.95; Zebrawood (WN200), $10.95; Cocobolo (WN300), $13.95; or Burmese rosewood (WN500), $12.95.

Kaleidoscope kit. Oil wand with rings, set of three mirrors, and acrylic dust covers. $13.95 ea. Choice of wand color: red (WN100), blue (WN101), purple (WN102), hot pink (WN103).

HUT Wood finish. Light color, 4-oz. stick, $9.95

All prices ppd. in U.S.
Craft Supplies USA,
1287 E. 1120 S.,
Provo, UT 84606,
or call 800/551-8876 to order.

Begin with the blank

1 Locate and mark the center on each end of a 2×2×9⅝" turning square. Grip the stock in a handscrew clamp, and stand it on one end on your drill-press table, making sure the stock's axis is perpendicular to the table.

2 Bore a 1 1/16" hole 9⅛" deep into the end. Flip the stock so the other end faces up, and drill a 3/16" hole into the center. Drill it through into the larger hole, as shown *below* in the Mounting the Blank drawing.

3 On one face, 1 3/16" from the large-bored end, center a mark. There, drill a ⅝" hole through the blank, passing through the center bore and perpendicular to it.

Turn the body

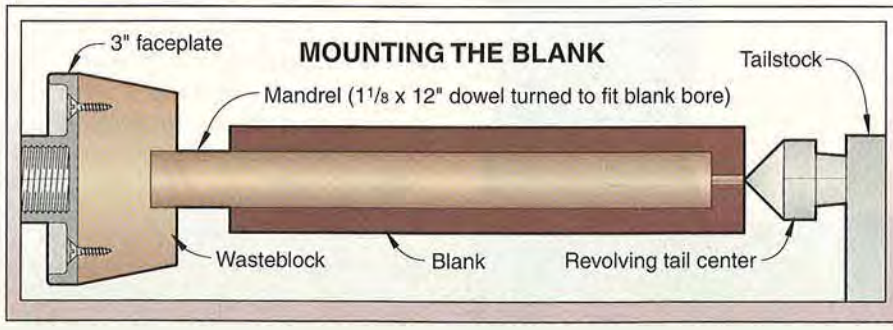
1 Lay out a wasteblock by tracing around your 3" faceplate onto a piece of 1½"-thick stock (2×6 construction lumber works fine). Bandsaw the piece, and attach it to the faceplate with screws.

2 Mount the faceplate, and true the face of the wasteblock. Using the gouge, bore a hole 1" deep into the center to receive a 1⅛" dowel rod. The dowel rod should fit snugly into the hole.

3 Locate and punch-mark the center on one end of a 12" length of 1⅛" dowel rod. Insert the unmarked end into the wasteblock hole. Press it in and glue it, if you wish. Engage the point of the live tail center in the punch mark.

4 With the skew or by sanding, reduce the diameter of the dowel rod so the bored-out blank fits snugly over it. The blank must not be able to move from side to side on this mandrel.

5 To mount the blank, fit it over the mandrel, and bring the tail center up to engage the small hole in the end of the blank, shown *below*. Tighten the tail center sufficiently



Tape holds the three mirrors in position to fold into a triangle.

Slide the mirror assembly into the body. It should fit snugly to prevent turning. Slide the mirror assembly into the body. It should fit snugly to prevent turning.

to bottom the mandrel in the wasteblock if you didn't glue it.

6 With the roughing gouge, round down the blank to 2" diameter, or as near 2" as possible. True the side and smooth the cylinder with the gouge or a skew.

7 Referring to the Full-Sized Pattern in the *WOOD PATTERNS®* insert in the middle of the magazine, lay out the coves and bead on the blank. Here's an easy way to do that: Fold the pattern in half along the centerline. Lay it on the toolrest with the folded edge toward the workpiece. Register the front line on the pattern with the front of the workpiece. Then, with the lathe running, hold a pencil against the blank at the four pattern lines to transfer the lines to the blank.

8 With the gouge, cut from the front of the front cove to the line marking the front of the bead. Cut the back cove, then form the bead. Taper the body to the back, following the dimensions on the pattern.

9 Undercut the front with the gouge, following the general contour of the dotted line at the front of the pattern. Don't cut into the ⅝" holes. You can cut partially into the mandrel for tool clearance as you hollow out the front—just don't go too far.

10 Sand and finish the kaleidoscope body. (We finished ours on the lathe with HUT Wood Finish, a stick containing wax and fine abrasives. With the lathe running, we rubbed the turning with the waxy stick, then buffed it with a cloth.)

11 Dismount the body. Enlarge the 3/16" hole to ¼". (To drill the hole out, we stood the kaleidoscope on end on the drill-press table and held it by hand.)

Assemble the kaleidoscope

1 Test the oil wand's fit in the ⅝" holes. If it doesn't slip in easily, enlarge the holes slightly by sanding or filing.

2 The kaleidoscope mirrors are front-surface mirrors; that is, the reflective coating is on the front of the glass rather than the back. The peel-off covering protects and helps identify the front surface, so leave it in place while handling and assembling the mirrors.

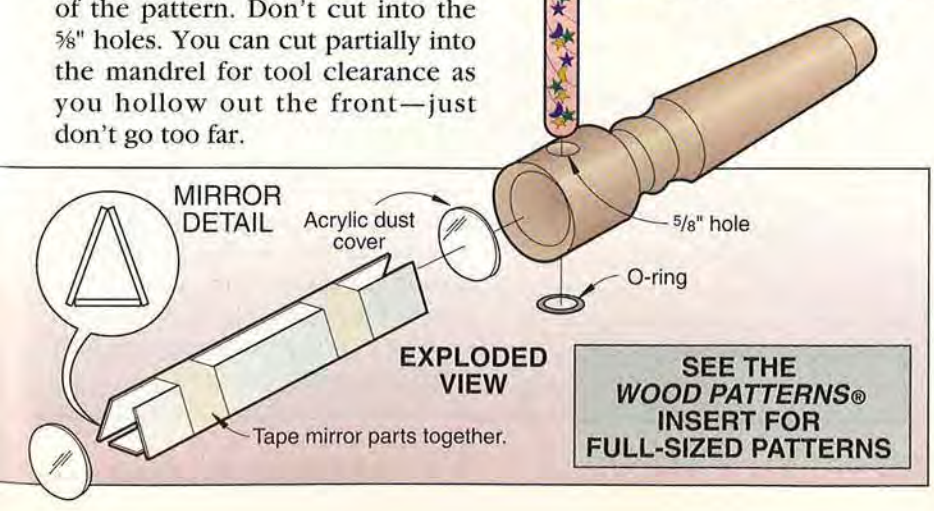
3 Stick a piece of tape about 3½" long across the back of the narrow mirror near each end (we used masking tape). Leave a tab about 1" long extending past one edge.

4 Stand one of the wide mirrors on edge on the 1" tape tabs, its front surface adjoining the edge of the narrow mirror. Bring the tape up, and press it to the back of the mirror. Lay the mirror back, then do the same thing with the other mirror on the longer tape tabs. Your mirrors should now look like the set in the photo *above left.*

5 Remove the protective film from the mirrors. Fold the mirrors into a triangle, bringing the two wide mirrors together above the middle of the narrow one. The narrow mirror should fit between the two wide ones, as shown in the Mirror Detail. Bind the assembly together tightly with the tape. Wrap another strip of tape around the middle.

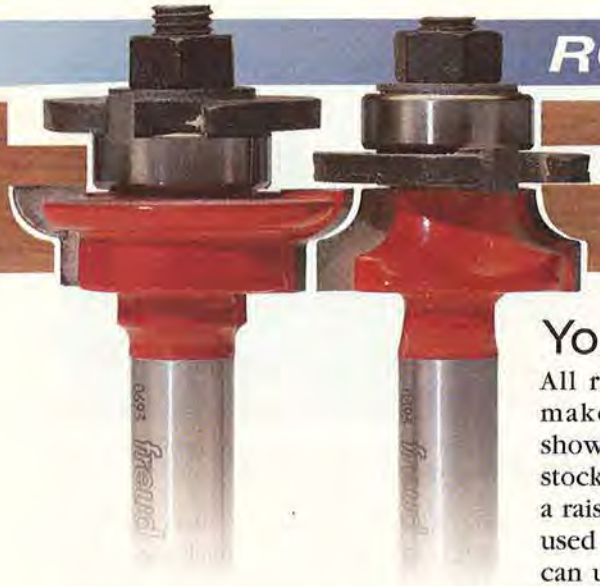
6 Drop one of the acrylic dust covers (in the kit) into the kaleidoscope body, then slide the mirror assembly in, as shown *above right.* (For the best kaleidoscopic visions, align the long axis of the mirror triangle with the wand.) If the mirror set fits loosely, wedge it in with one of the supplied felt dots or tape. Place the other dust cover on the end of the mirrors, securing it with a dab of silicone or a drop of cyanoacrylate adhesive.

7 Slide the oil wand into the holes. Center it, and slip one of the O-rings on from each end to hold it in place. Then, lean back, peer in, and enjoy the show.



Photographs: King Au; John Hetherington
Illustrations: Roxanne LeMoine; Lorna Johnson

RAIL-AND-



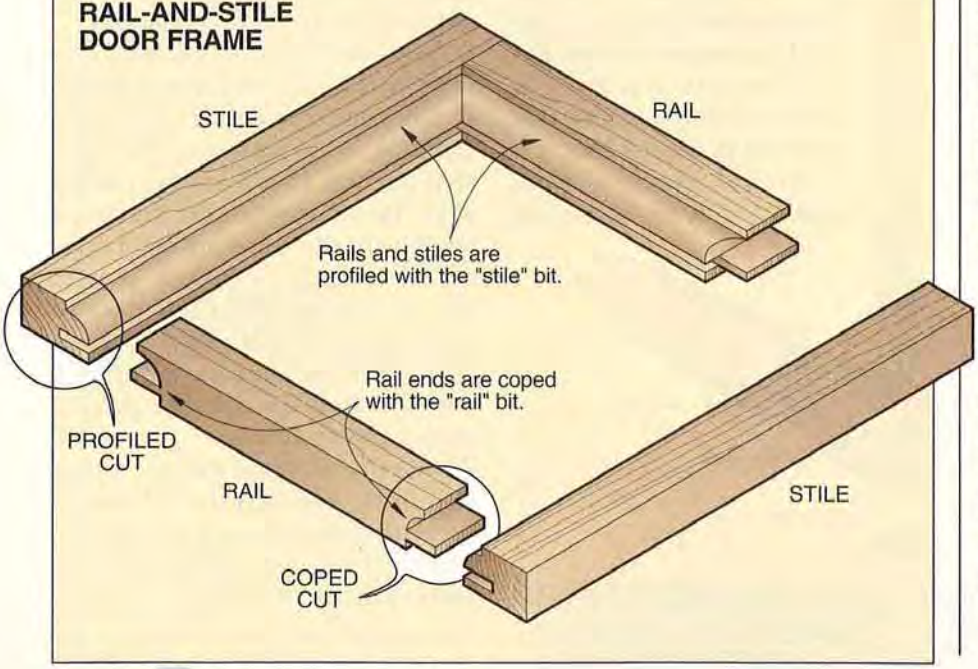
If you've always wanted to make traditional-style frame-and-panel doors, there's no better way to do it than with rail-and-stile router bits. (They're also called stile-and-rail, cope-and-stick, or cope-and-pattern bits.) In one pass, these bits cut interlocking joints for the frame pieces, impart a decorative profile, and leave a groove for holding the door panel. Here's what you need to know about selecting and using rail-and-stile bits.

You can choose from four types of bits

All rail-and-stile bits help you make frames such as the one shown *below* from ¾ to ⅞"-thick stock. These frames typically hold a raised panel and most often are used as cabinet doors. You also can use frame-and-panel assemblies as cabinet sides, furniture components, and for paneled walls and ceilings.

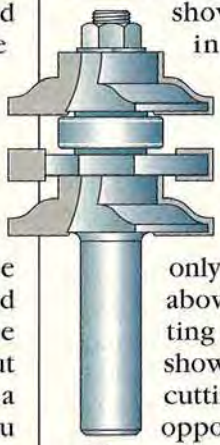
Note that the frame requires two cuts: a coped cut on the ends of the rails, and a profiled cut on the inside edges of the rails and stiles. The profiled cut produces a groove for holding a panel. As we'll describe next, you can make these cuts with a single bit that you lower and raise in your router table to make the two cuts, a single bit with cutters that you reconfigure, or separate bits. We've tried all of the various types on a router table, and here are the pros and cons of each.

RAIL-AND-STILE DOOR FRAME



• *One-piece bits*

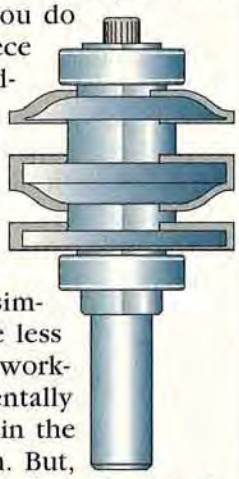
We found two styles of rail-and-stile bits in this type. The type shown *left* has a bearing in the center of the assembly, and two profile cutters in the same orientation. Several companies supply this bit.



Another style, sold only by CMT, has bearings above and below the cutting portion of the bit as shown *below*. The profiled cutting edges are oriented opposite each other.

These bits fall in a mid-price range, costing $70–$105 depending on the supplier. With these bits you do not have to reconfigure the cutters to change from a coped cut to a profiled cut. You simply raise the height of the bit in your router table.

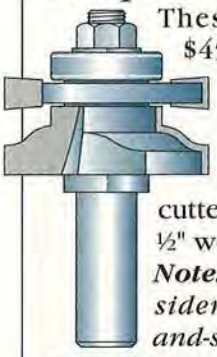
With the one-bearing style of this bit, you make the coped cut with the *face side of the stock up* and the profiled cut with the *face side down,* just as you do with the one-piece reversible models. With the CMT bit you make both cuts with the workpieces *face side up*. This makes the operation simpler, and you're less likely to ruin a workpiece by accidentally placing its face in the wrong direction. But, you still need to plane the boards to exact thickness to ensure that the fronts come out flush.



Print this article

STILE BITS

• One-piece reversible bits



These bits sell for $45–$65 and are your lowest-cost option. They consist of a bearing, slotting cutter, and profile cutter stacked on a ¼" or ½" work arbor.

Note: *Because of the considerable mass of rail-and-stile bits, we recommend only models with ½" work arbors or shanks. Also, for safety and accuracy we suggest you use them only in a router table.*

One-piece reversible bits require considerable setup time because you need to switch the order of the bearing and cutters for the coped and profiled cuts. This can be tricky because you need to add thin metal washers (called shims) between the components to cut tight-fitting workpieces. Also, you need to remember to make the coped cuts with the rails *face side up*, and the profiled cuts with rails and stiles *face side down.*

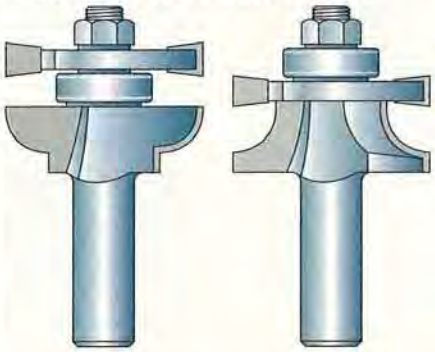
Because you don't make both cuts with the face side down, it's essential that your stock be planed to exactly the same thickness. Otherwise, the faces of the rails and stiles will not be flush with each other after assembly.

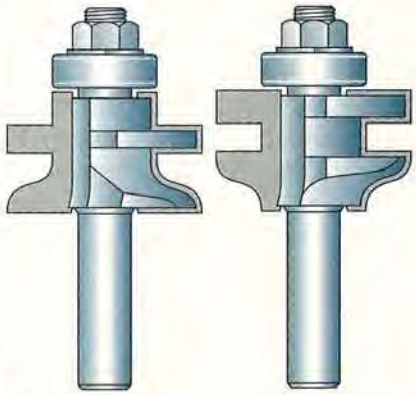
• Two-piece adjustable bits

These bits cost $100–$125 per set, making them your most-expensive option. However, they offer a number of advantages that justify their added cost.

With these sets you have separate bits for the coped and profiled cuts. For both cuts, you place all workpieces *face side down*. Since the faces are referenced off the router tabletop, they always come out flush on the face side (provided the bits are adjusted properly), even if your workpieces vary slightly in thickness.

With these bits you also have a greater selection of styles than the one-piece sets. In addition to ogee, straight bevel, and cove-and-bead styles, which are available with all types of rail-and-stile bits, manufacturers of two-piece sets offer you bead and round-over profiles such as the ones shown *below.*





• Two-piece non-adjustable bits

These mid-priced bits (about $75 per set) work like the two-piece adjustable versions insofar as you position the face sides of your workpieces down for both cuts. In our tests these bits made acceptable cuts, but the joints were slightly looser than those we cut with the other types of bits. And, the joints will become looser each time you sharpen the bits because you cannot adjust the spacing between their cutting edges.

During our trials, we found the bearings located at the top of the bits to be too high to contact a ¾"-thick workpiece. And, these bearings do not provide an accurate reference for aligning your router-table fence (we'll show you how to do this in the next section).

Continued

So which type is best for you?

Regardless of your budget, your best choice is either the CMT one-piece bit (call 800/531-5559) or one of the two-piece adjustable sets (we've had good results with many brands).

If you want to keep things as simple as possible, go for the CMT bit. You'll get tight joints with no shimming. You do need to plane your workpieces to exact thickness, but that's a good rule to follow no matter which bit you use.

Because you cannot adjust the cutters in this bit, your joints will become slightly looser with each sharpening. However, this bit will help you make many door frames before it produces unacceptable joints. A home woodworker may never make enough door frames to require sharpening the bit.

For $10–$35 more, a two-piece adjustable set gives you a greater selection of styles (including the ever-popular round-over), and can be adjusted after sharpenings. It also sits lower during the profiled cut, which seems safer than the tall one-piece bits.

How to get great results with rail-and-stile bits

The key to success with rail-and-stile bits is in setting up the bits for coped and profiled cuts that fit tightly together and self-align the faces flush with each other. Although the various types of rail-and-stile bits require slightly different bit adjustments and workpiece orientation, the basic procedure is similar for all of them. Here's how we go about getting great results with our preferred type of rail-and-stile bits—a two-piece adjustable set.

Note: *It's always a good idea to test your router-table setups with scrap stock. Also, use scrap stock for Steps 2, 3, and 4 after each bit resharpening. Once you are satisfied that the bits will produce tight-fitting joints (you may need to add metal shims to those bits that accept them), cut your rails and stiles to length. If you've never used these bits before, it's a good idea to first make several complete frames with scrap stock.*

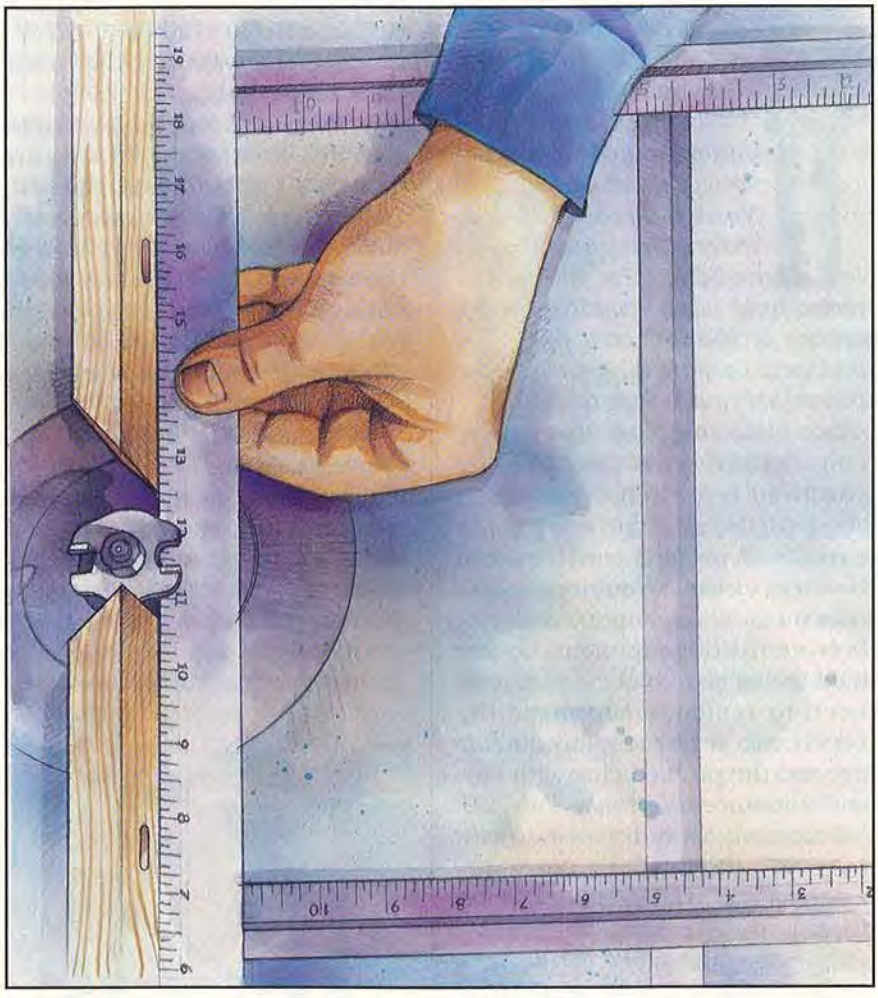
Want to know more about making frames and panels?

For more information on this topic, see the article "High-Styled Raised Panels and Frames," in the August 1993 issue of *WOOD*® magazine. If you don't have access to this article, we would be glad to send you a copy. Simply send $4 and a stamped, self-addressed envelope to:

Frame-and-panel article
WOOD Magazine, GA310
1912 Grand Avenue
Des Moines, Iowa
50309-3379

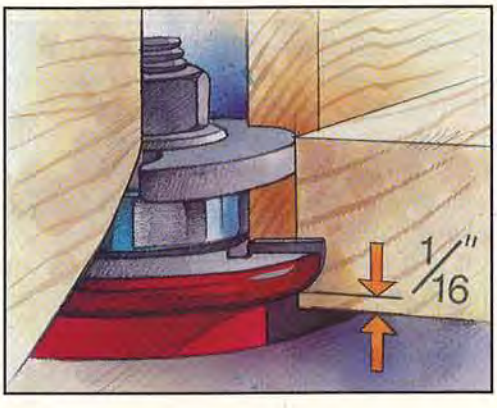
1 Set up the fence

With a straightedge at least as long as your router-table fence, and a pair of 12" rules, align the fence flush with the bearing on the "rail" bit (the bit with the bearing in its middle), and parallel with the miter-gauge slot. If your router table doesn't have a miter-gauge slot, just align the fence and bearing flush.



2 Elevate the rail bit for the coped cuts

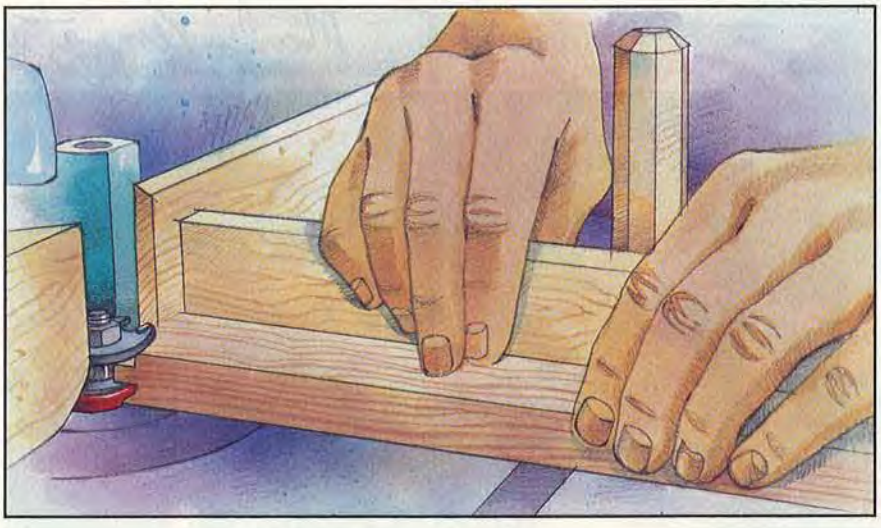
Using a scrap of wood as an aid, adjust the rail bit so there's a space of about 1/16" between the table and the profile portion of the rail bit as shown *right.*



3 Cut the end grain on the rails

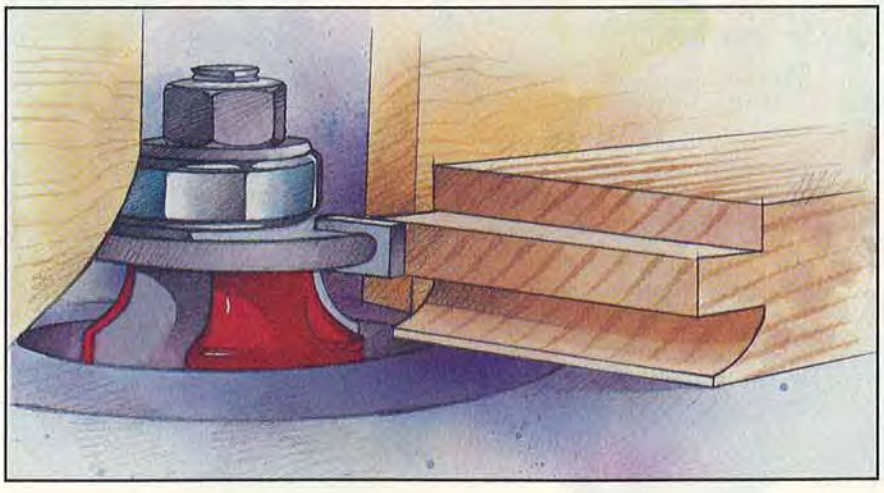
First, attach a ¾" plywood auxiliary face to your miter-gauge. The auxiliary face should butt against the router-table fence. (This piece supports the workpiece and helps prevent grain tearout on the exit side of the cut.) Then, hold the rail face side down, with either edge firmly against the miter gauge, and its end butted against the fence. Turn on the router and slowly rout the workpiece to make the coped cut. Turn the rail around, keeping its face side down, and cut its other end. Repeat this procedure for all of your rails.

If your router table doesn't have a miter-gauge slot, you can use a ¾×10×12" scrap of plywood in place of a miter gauge. Simply butt the long edge of the plywood against the fence, and hold the rail against the adjacent edge facing the router bit.



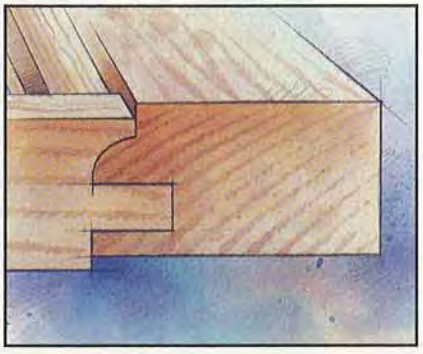
4 Set up the stile bit for edge-grain profiled cuts

Install the stile bit and elevate it so its slot cutter aligns with the tenon on a rail end as shown *below*. Make an edge-grain cut in a piece of scrap stock of the same thickness as your rails and stiles.



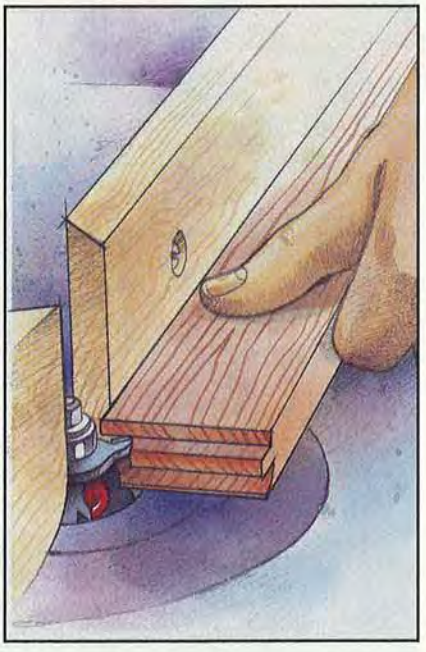
5 Check your results and make adjustments

Fit together the scrap piece you just cut and one of your rail ends. Both faces should align flush. If they don't, you'll need to adjust the height of the stile bit. In the example *below,* the stile bit needs to be adjusted down.



6 Make the edge-grain cuts

Pass the inside edges of the rails and stiles through the stile bit, face side down. That's it. You should have the components for a perfect rail-and-stile frame!



Written by Bill Krier with Chuck Hedlund
Illustrations: Kim Downing, Brian Jensen
Photograph: Doug Hetherington

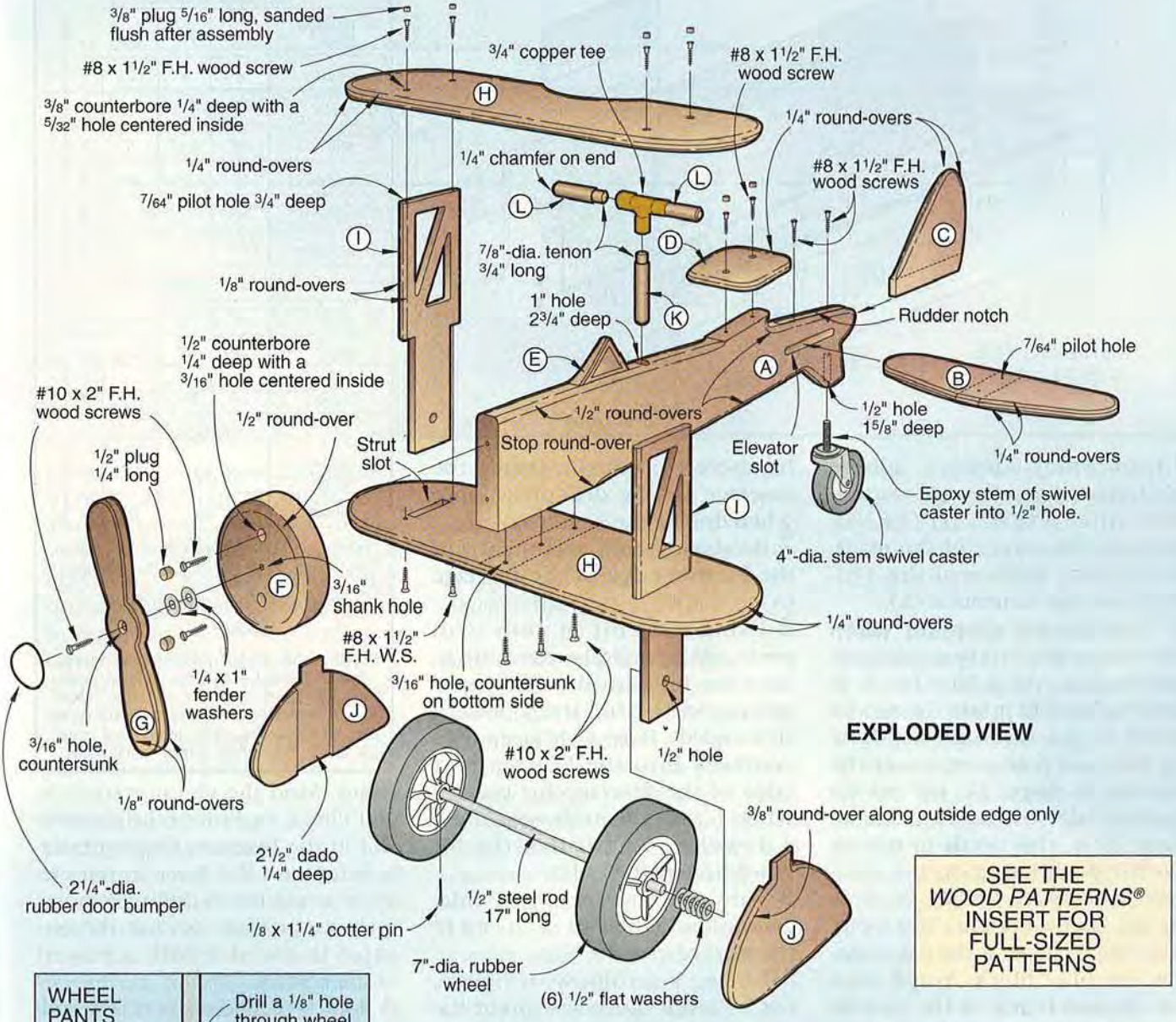
Kid-powered BARNSTORMIN'

Over the years we've found kids to be the best toy testers around. You can count on their being honest. That's why after building our first prototype, we took it to my son's day-care center for some "expert" advice. We found out that we needed to spread the front wheels apart and move the seat farther back for greater stability. And, that pinning the front wheels to the axle helped the plane track straighter. Now, after making the necessary adjustments, we're sure that we've got a project that will suit your young aviator and provide him or her with many enjoyable hours of fun.

Marlen Kemmet

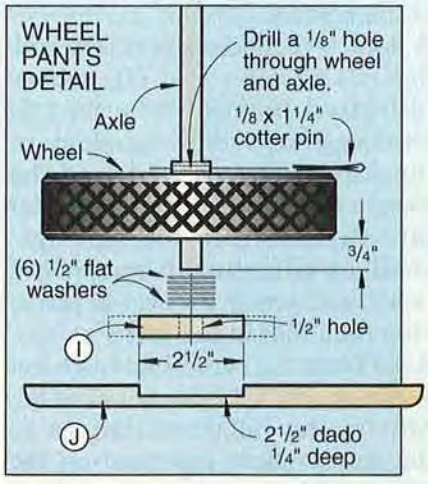
Marlen Kemmet Senior Editor/How-To

BIPLANE



EXPLODED VIEW

SEE THE *WOOD PATTERNS®* INSERT FOR FULL-SIZED PATTERNS



Note: *For your convenience, we've had a kit put together that includes all the hardware needed to build the plane and another kit with the vinyl decals. See the Buying Guide at the end of the article for our sources.*

First, laminate some stock to form the fuselage

1 Cut four pieces of ½"-thick stock to the sizes shown on Forming the Fuselage drawing. To maximize the strength of the fuselage tail, note the grain direction of the pieces on the drawing and on the Cutting Diagram.

2 Spread an even coat of glue on all mating surfaces, then clamp the fuselage pieces (A) together in the configuration shown on Forming the Fuselage drawing, keeping the edges and ends flush. Using a chisel, remove glue squeeze-out from the rudder notch before it dries.

Continued

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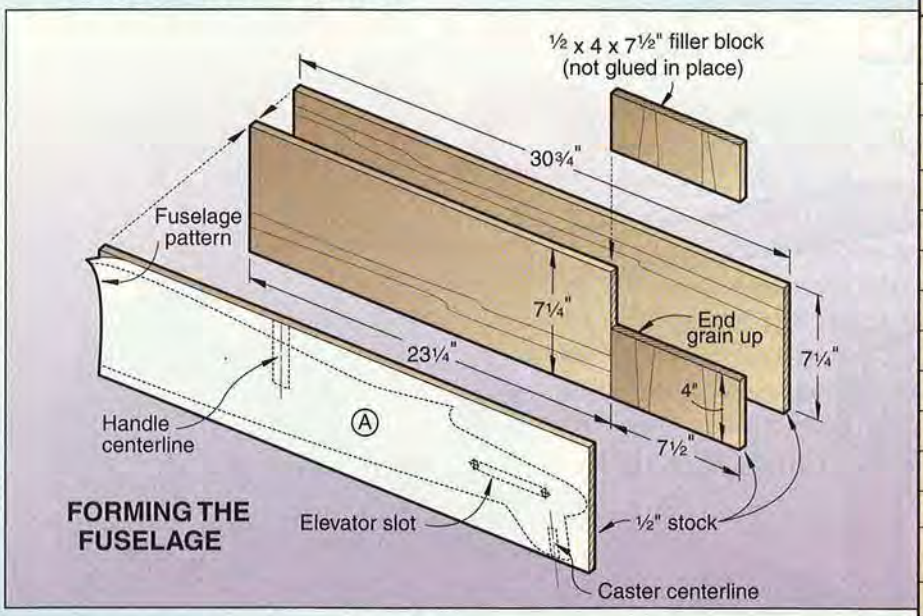
Barnstormin' biplane



Bill of Materials

Part	Finished Size T	W	L	Matl.	Qty.
FUSELAGE ASSEMBLY					
A fuselage blank	1½"	7¼"	30¾"	LP	1
B elevator	½"	5"	14⅞"	P	1
C rudder	½"	8⅝"	7¼"	P	1
D seat	½"	4½"	5"	P	1
E* windshield	½"	2"	3¾"	P	1
F cowling	1½"	6" dia.		P	1
G propeller	½"	2¼"	10⅞"	P	1
WING ASSEMBLY					
H wings	½"	7¼"	26"	P	2
I struts	½"	4"	14⅜"	P	2
J wheel pant blanks	½"	6⅛"	10"	P	2
HANDLE					
K handle upright	1" dia.		6¼"	D	1
L handles	1" dia.		4½"	D	2

*Initially cut parts marked with an * oversized. Trim to finished size according to the instructions.

Materials Key: LP–laminated pine, P–pine, D–dowel.

Supplies: 12–#8×1½" flathead wood screws, 7–#10×2" flathead wood screws, 2–¼×1" fender washers, 12–½" washers, 2–7"-dia. rubber wheels, ½" steel rod 17" long, 2–⅛×1¼" cotter pins, ¾" copper tee, 4"-dia. stem swivel caster, 2¼" rubber door bumper, primer, enamel paints.

3 Using spray adhesive, adhere the full-sized fuselage (A) pattern from the *WOOD PATTERNS®* insert in the center of the magazine to one surface of the 1½"-thick fuselage lamination (A).

4 To minimize chip-out when machining the top rear edges of the fuselage, cut a filler block to ½×4×7½" and fit it into the rudder notch in the fuselage. Bandsaw the top and rear portions of the fuselage to shape. *Do not cut the bottom edge* of the fuselage to shape now, this needs to remain flat for positioning on the drill-press table when drilling the hole for the handle-upright. When cutting the top edge of the tail, bandsaw the filler block. You'll need the shaped block in the rudder notch for the router bearing to ride on when routing the top of the fuselage in the next step.

5 Fit your router with a ½" round-over bit, and rout the bandsawed edges of the fuselage.

6 Using a 1" Forstner bit in your drill press, position the fuselage on the drill-press table, and align the bit with the handle centerline on the full-sized pattern adhered to the fuselagd. Bore a 1" hole 2¾" deep *centered* in the top edge of the fuselage. (We used two large handscrew clamps to steady the fuselage on the drill-press table when drilling the handle hole.)

7 Bandsaw, sand, and then rout the bottom edge of the fuselage (A) to shape.

8 Using a ½" bit in your drill press, tilt your drill-press table to align the bit with the caster centerline on the full-sized pattern (it's angled). Bore a 1⅝"-deep hole *centered* into the bottom rear edge of the fuselage for the tail wheel (caster). You also could use a doweling jig to align the bit when drilling the hole.

9 Turn the fuselage on its side, and drill a ½" hole at each end of the marked elevator slot.

10 Using a scrollsaw or jigsaw, cut between the holes to cut the elevator slot to shape. Sand the entire fuselage smooth.

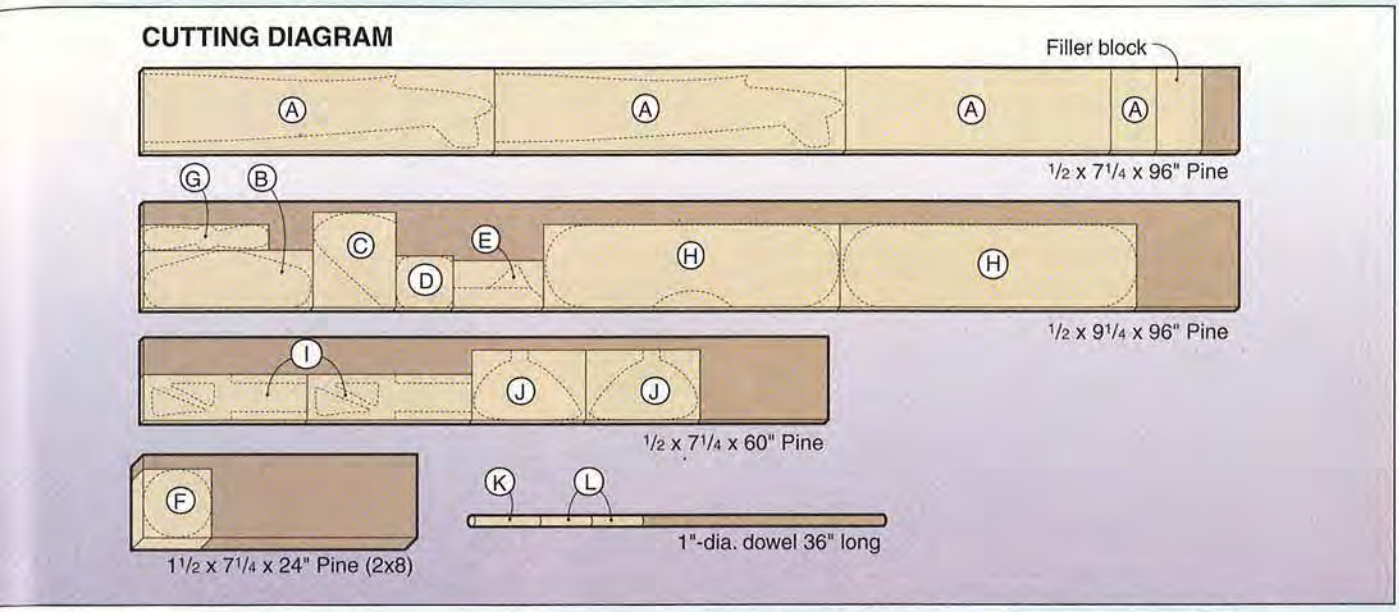
Add the elevator, rudder, seat, and windshield

1 Transfer the patterns from the *WOOD PATTERNS* insert to ½" stock, and cut the elevator (B), rudder (C), and seat (D) to shape.

2 Drill a pair of countersunk mounting holes through the elevator where marked on the pattern. Remove the paper pattern, and rout ¼" round-overs along the edges. Sand the elevator smooth, and check its fit into the elevator slot in the fuselage. Once properly fitted, use the holes in the elevator as guides to drill pilot holes into the fuselage. Secure the elevator in the slot with a pair of wood screws.

3 Rout ¼" round-overs on the rudder (C) and the seat (D) where indicated on the patterns and Exploded View drawing. Remove the paper patterns, and sand the pieces smooth. Glue the rudder into the notch in the fuselage. Drill counterbored mounting holes, and screw the seat in place. Plug the holes in the seat.

4 To form the windshield (E), cut a piece of ½" stock to 4×8". Adhere the full-sized pattern to the stock where indicated on the Cutting Diagram. Bandsaw along



the dotted line. Sand the cutlines smooth, and rout ¼" round-overs along the cut edges. Working with an oversized piece of stock makes it easier and safer when routing. Now, use your tablesaw to rip along the second cutline to form the flat bottom edge of the windshield. Glue the windshield in place, centered on the top edge of the fuselage and ½" ahead of the handle-upright hole.

Form the cowling and propeller next

1 From 1½"-thick stock (we used a scrap piece of 2×8, but you also could laminate thinner stock to form the blank), mark a 6"-diameter circle on the stock for the cowling (F). Bandsaw the cowling to shape.

2 Drill a 3/16" shank hole through the center of the cowling. Then, mark the location of and drill a pair of counterbored holes through the front face of the cowling for attaching it to the fuselage front later. Sand the cowling smooth (we used a disc sander to sand the bandsawn edges). Rout a ½" round-over along the front edge.

3 Glue and screw the cowling to the fuselage, and plug the holes.

4 Transfer the propeller (G) pattern to ½" stock, and cut it to shape. Drill a countersunk hole in the center of the propeller. Rout or sand ⅛" round-overs along the edges of the blades.

And now, add the wings

1 From ½"-thick stock, cut the two wings (H) to the size listed in the Bill of Materials.

2 Adhere the full-sized pattern to the top surface of the lower wing. Bandsaw and sand the wing to shape. Drill blade start holes and scrollsaw the strut slots in the bottom wing to shape.

3 To attach the lower wing to the bottom side of the fuselage and struts later, drill three 3/16" holes and four 5/32" holes through the the lower wing where marked on the pattern. Flip the wing over, and countersink all the holes on the *bottom side* of the wing.

4 Using the lower wing as a template, transfer its shape to the upper-wing blank. Mark a radius centered along the back edge of the upper wing. Cut the upper wing to shape.

5 Place the lower wing on the top surface of the upper wing, with the edges and ends flush. Using the holes in the lower wing as guides, drill four holes for attaching the upper wing to the struts. Separate the wings.

6 Rout ¼" round-overs along the edges of each wing.

Next, machine the struts that separate the wings

1 Cut two struts (I) to shape from ½" stock. Test-fit the struts in the slots in the bottom wing.

2 Adhere the strut pattern to one of the pieces. Drill blade start holes, and scrollsaw the openings in the strut to shape. Sand the scrollsawed edges smooth.

3 Using the first strut as a template, trace the openings onto the second strut, and scrollsaw those openings to shape.

4 Drill a ½" hole through the struts for the steel axle.

5 Rout ⅛" round-overs along the edges of the struts where shown on the full-sized pattern and Exploded View drawing.

Fashion the wheel pants next

1 Cut two pieces of ½" stock to 6⅛×10" for the pant blanks (J).

2 Using your tablesaw, cut a pair of ¼"-deep dadoes across each blank where shown on the Wheel Pants drawing. *The width of the dado needs to be the same as the*

Continued

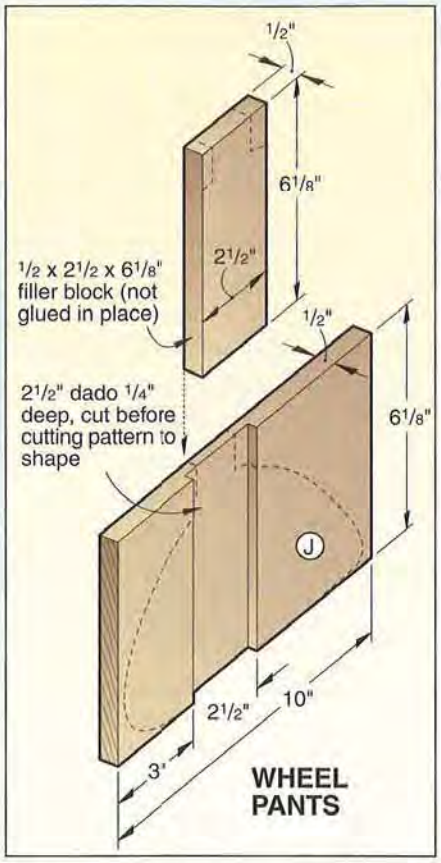
width of the bottom end of each strut (ours measured 2½"). Check the fit of the struts into the dadoes in the pants.

3 Place the pants dadoed surface to dadoed surface, and cut a filler block to fit between the mating dadoes. Tape the pieces together with the filler block in place, and bandsaw the pants to shape.

4 Rout ⅜" round-overs along all but the *top edge* of the taped-together pants. The filler block gives the bit bearing a surface to ride on when routing the round-over along the top outside edge of each pant. (We darkened the filler block for the photo on the *next page* so it would be more visible.) Sand the pants, pry them apart, and remove the filler block and paper pattern.

5 Finish-sand the wings and struts. Glue and clamp the struts between the wings as shown in the photo *above right*. Verify that the struts are square to both wings and parallel to each other. Drive the screws through the top surface of the top wing and the bottom surface of the bottom wing to secure the assembly.

6 Square the fuselage to the lower wing. Clamp the fuselage to the wing. Using the previously drilled holes in the lower wing as guides, screw the assemblies together as shown in the photo on the *opposite page*.



Below: **After cutting the taped-together wheel pants to shape, rout a round-over along the edges of the pants.**

Center: **Glue and clamp the struts between the wings. Drive the screws, and plug the holes. Sand the plugs smooth.**

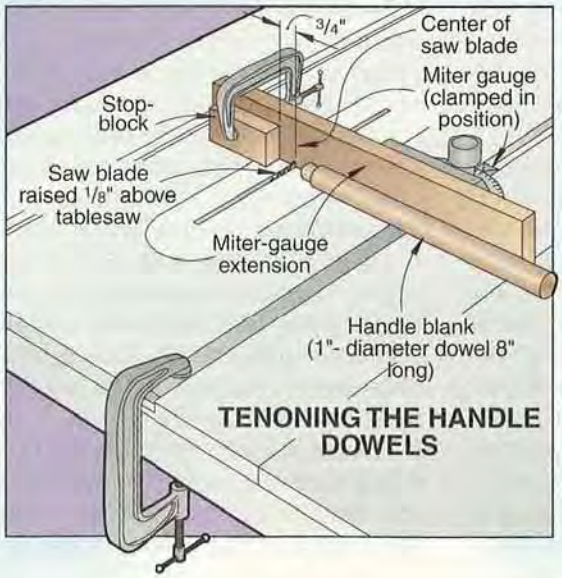
Far right: **Clamp the lower wing to the fuselage, and drive the screws to secure the assemblies together.**

Next, let's make the handle

1 Cut three pieces of 1" dowel to 8" long each. Fit your miter gauge with a wood extension and stop as shown on the Tenoning the Handle Dowels drawing.

2 Raise your tablesaw blade 1/16" above the surface of the saw table, and position the miter gauge so the center of the dowel is centered over the highest point of the blade. Clamp the miter gauge to your saw table.

3 Turn on the saw, push a scrap piece of dowel over the spinning blade and against the stop. Continue moving the dowel over the blade until a ⅞"-diameter tenon is created on the end of the dowel. Test-fit the tenoned end of the dowel into a ¾" copper tee. Adjust the blade height if necessary until the tenon fits snugly into the tee without having to be forced on.



4 Once you've accurately positioned the blade, cut a ¾"-long tenon on one end of each 8"-long piece of dowel. Once each piece of dowel has been tenoned, crosscut the handle upright (K) and handles (L) to the lengths listed in the Bill of Materials.

5 Sand a ¼" chamfer on the end of each 1" dowel opposite the tenoned end. Epoxy the tenoned dowels into the copper tee.

Final assembly before taxi and takeoff

1 Fill any gaps with putty, and finish-sand the pieces. Prime all the surfaces *except* the dadoed area of the pants and their mating location on the strut. These need to be paint-free for a good glue joint. (We masked these areas before priming.)

2 Paint the cowling and seat red (we used Krylon cherry red, #2101). Mask off the seat and cowling , and paint the rest of the plane yellow (we used Krylon daisy yellow, #1813). See our detailed description for painting this project on *page 29*.

3 Paint the propeller yellow. Mask the inner portion, and paint the ends of the blades red.

4 Apply a clear finish to the dowel-handle assembly, masking off the portion of the upright dowel (K) that will fit into the hole in the fuselage.

5 Cut the axle (½" steel rod) to length (we used a hacksaw). Use spring clamps (no glue yet) to secure the pants to the struts, with the steel axle, wheels, and washers in the configuration shown on the Wheel Pants detail accompanying the Exploded View drawing. Drill a ⅛" hole through each plastic wheel rim until the bit touches the steel axle and leaves a slight indentation or marking on the axle. Then, remove the axle and wheels from the plane, and drill a ⅛" hole through each axle at each of the two marked indentations. (We did this on the drill press using a V-block jig to hold the axle steady while we drilled directly through the center of the steel axle.) Put the wheels back on the axle so the holes in the axle align with the hole in each wheel rim. Using the hole in the axle as a guide, drill through the opposite edge of the wheel rim. (We used a jobbers bit—an extra long drill bit—to drill through the opposite edge of the wheel.) *So the plane will track straighter, it is important to pin both wheels to the axle.*

6 Put paraffin or several drops of oil in the axle holes in the wheel pants. If you don't, the steel axles will squeak. Then, place the wheels and washers on the axle. Fit the axle assembly between the pants, and glue and clamp the pants to the bottom of the struts.

7 Epoxy the rear swivel caster into the hole in the tail of the fuselage. Wipe off excess epoxy.

8 Hand-paint the decorative stripping on the plane, or order the vinyl decals listed *below*.

9 Attach the propeller to the cowling so it spins freely. And add the nose cone (rubber door bumper) to the propeller with a piece of two-faced tape.

Buying Guide

Hardware kit. Includes all the hardware (except primer and paint) listed in the Supplies list at the end of the Bill of Materials. Kit #WD-BP, $34.95 ppd. Miller Hardware, 1300 M.L. King Parkway, Des Moines, IA 50314. Or, call 515/283-1724 to order (no COD's please).

Vinyl decals. Decals plus application instructions, $29 ppd. Kness Signs, 5291 NW 72 Street, Des Moines, IA 50322. No phone orders please.

Written by Marlen Kemmet Project Design: James R. Downing Illustrations: Kim Downing; Lorna Johnson Photographs: Bill Hopkins

CORDLESS DRILLS

Our exclusive tests reveal today's most-powerful models

Cordless drills have come a long way since their introduction in the '70s. Thanks largely to vastly improved battery technology, today's best models handle any drilling or fastening task with ease and convenience. Of course, some models run stronger and longer than others, and in this article we'll tell you how to get the most for your cordless-drill dollar.

Print this article

A few words about our testing procedure

Developing a fair and accurate means of testing a group of tools never comes easy. With cordless drills, driving pound after pound of screws, or drilling thousands of holes to see which tool outperforms another involves several hard-to-control variables. Inconsistent wooden test pieces, drill and driving bits that wear with use, and the human element make the potential for error skyrocket (nobody can drill each hole or drive each screw with the exact same pressure and efficiency).

With this understanding, *WOOD*® magazine tool tester Bob McFarlin built a "dynamometer." (You can read more about his invention on *page 1*). The dynamometer provided us with error-free readouts of each drill's performance in areas such as run time, speed, and torque. And, with this instrument we were able to apply real-life workloads to the drills as we put them through their paces.

To guarantee the absolute accuracy of our results, each drill's battery pack was "cycled" (completely discharged and charged) six times before the tests began. This vital step puts the drills on equal footing by bringing each battery up to peak performance. (Our tests showed that batteries that haven't been charged for a while may not hold a full charge until being cycled a few times.)

Then, we ran each machine through our dynamometer test six times and averaged the results. As witness to the accuracy of the dynamometer, we found that each drill produced nearly the exact same results with each of the six tries.

Three key performance areas

The charts on the following pages show how the various models fared in three tests performed on the dynamometer. Here are some important points to remember about each performance area:

•**Torque.** This tells you the maximum amount of turning force a drill exerts (measured in inch-pounds). A drill/driver with high torque will bury long screws and make large-diameter holes in tough woods better than a drill/driver with low torque.

How much torque is enough for your needs? In our tests, we found that it requires only about 10 inch-pounds of torque to drive a 2" screw into pine. Screws longer than 2" are best driven with a tool that delivers at least 40 inch-pounds of torque. To drive lag screws into pine without a pilot hole, you will need a drill/driver

with at least 100 inch-pounds of torque. And for boring with a hole saw, get a drill with at least 150 inch-pounds of torque.

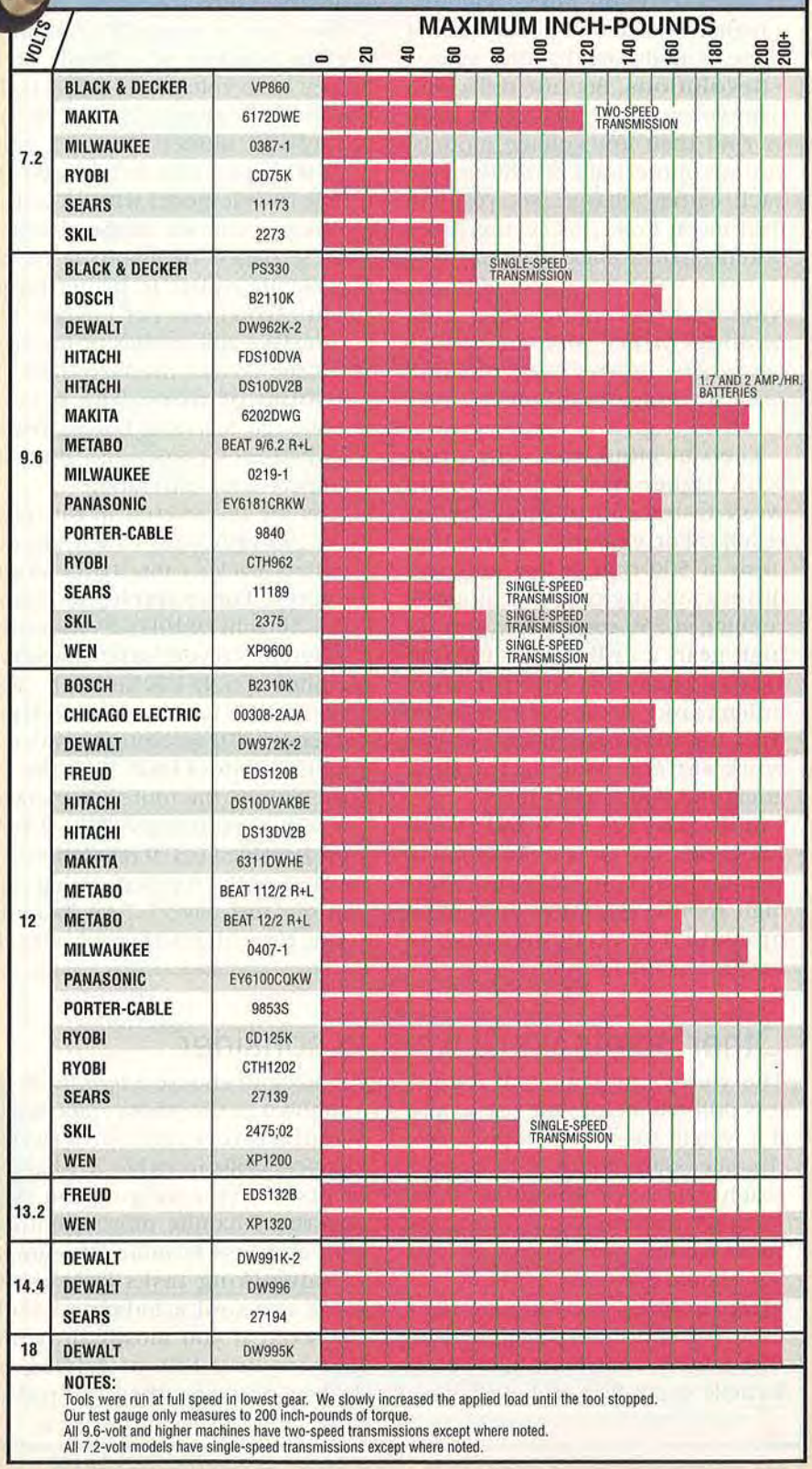
For most tasks requiring more than 40 inch-pounds of torque, your best bet is a drill with a two-speed transmission. That's because high torque levels can be achieved in low-speed gear ranges only.

You will note in the chart *right* that we do not list torque readings that exceed 200 inch-pounds. Our test gauge stopped at 200 inch-pounds, but since a drill with 200 inch-pounds of torque did every task we put before it, we don't think ratings over 200 inch-pounds should be a determining factor in your buying decision.

• **Run Time.** In our tests we found that higher-voltage drills do not necessarily run for longer periods of time on one battery charge than

Continued

TORQUE
It tells how much muscle a drill has



NOTES:
Tools were run at full speed in lowest gear. We slowly increased the applied load until the tool stopped.
Our test gauge only measures to 200 inch-pounds of torque.
All 9.6-volt and higher machines have two-speed transmissions except where noted.
All 7.2-volt models have single-speed transmissions except where noted.

lower-voltage drills. So, the battery of a 7.2-volt drill may last as long as the battery of a 14.4-volt drill. But, as you'll see in the next paragraph, a higher-voltage drill performs a lot more work during that time span.

•**Revolutions.** Because drills with high voltage generally run at higher rpm than low-voltage models, you get more total revolutions on each battery charge. So, you will drill more holes, or secure more fasteners, on a single charge.

***Note:** Our rpm ratings differ from manufacturers' no-load ratings because we applied loads that simulate working conditions.*

Keep in mind, too, that drills with higher rpm will help you work faster and produce better results. For example, a drill that turns at 500 rpm in low gear will drive screws twice as fast as a drill running at 250 rpm in low gear. In high gear, a drill should turn no slower than 800 rpm for most drilling tasks. At slower speeds the drill bit tends to "hack" at the work surface, making for slow going and poor-quality holes.

In the 9.6-, 12-, 14.4- and 18-volt categories, the DeWalt drills ran at the highest rpm. Despite their high rpm levels, these drills keep up with their competition in torque and total revolutions.

There's more to a tool's power than just voltage

In terms of power, manufacturers classify cordless tools according to battery-pack voltage. Because these packs typically contain an even number of 1.2-volt cells, they have voltages of 7.2, 9.6, 12, and 14.4. (Freud and Wen sell 13.2-volt models with 11 cells; DeWalt recently introduced the first 18-volt model with 15 cells.)

As you can see in the charts on these pages, high-voltage ratings generally equate to higher torque and revolutions per charge. But, all makes and models of the same voltage do not produce the same amount of work. The reason? Although few tool buyers realize it, batteries come with differing ampere hour (Ah) ratings.

As we discovered in our tests, the Ah rating says a lot about a battery pack's capacity for storing energy. For example, we tested the Hitachi DS10DV2B with three different 9.6-volt batteries with Ah ratings of 1.2, 1.7, and 2.0 . With the 1.2-Ah battery, the drill produced 3,970 revolutions under 10 inch-pounds of load. With the 1.7-Ah battery, the tool's chuck made 4,970 revolutions. The 2.0-Ah pack yielded 6,379 revolutions.

Most of the top-performing drills in our test have 1.7-Ah batteries. The Hitachi 2.0-Ah pack was the first of its type we've tried, but you can expect to see other manufacturers crash the 2.0-Ah barrier soon. Since cordless-drill manufacturers buy their batteries from the same sources (Sanyo, Panasonic, or Energizer), similar technology is generally available to all of them. With many brands, including Hitachi, the high-Ah batteries are compatible with drills and chargers originally sold with low-Ah batteries of the same voltage.

Although high-Ah ratings have a positive effect on total revolutions by increasing the storage capacity of a battery pack, they do not increase rpm or maximum torque output. In our tests, the Hitachi DS10DV2B produced about 170 pounds of torque regardless of the Ah rating of its battery.

The great part about high-Ah batteries is that they don't add any bulk to the tool (unlike high-voltage drills that become bigger and heavier with each increase in voltage). The downside to high-Ah batteries is that they are new technology, so they cost more. For example, a Hitachi 1.2 Ah, 9.6-volt battery sells for about $45. The same pack with 1.7 Ah sells for about $65.

Currently, most manufacturers do not put Ah ratings on battery

Other points you'll want to consider

The world's most powerful cordless drill will be of little use to you if it weighs too much, doesn't have the necessary controls in easy-to-reach places, or doesn't fit comfortably in your hand. Here are some factors, besides power, that you should consider:

•**Ergonomics**. The full-page chart lists five important specifications that largely determine how comfortable you'll find each drill. First, you need to choose a *handle style*. As shown in the photo *right*, some manufacturers offer otherwise-identical drills in either a T-handle or pistol-grip configuration. We find the T-handle more comfortable and less fatiguing for most woodworking tasks because it gives the tool a balanced feel. However, if you mostly do work that requires lots of driving or drilling pressure, then the pistol-grip style places your gripping hand more in line with the direction of pressure.

If you settle on a pistol-grip model, take a look at the *length from trigger to chuck tip* column of the full-page chart. High numbers in this column tell you that the drill is quite nose-heavy.

The *overall length to nose of chuck* and *height* columns give you a good idea of a drill's bulki-

Continued

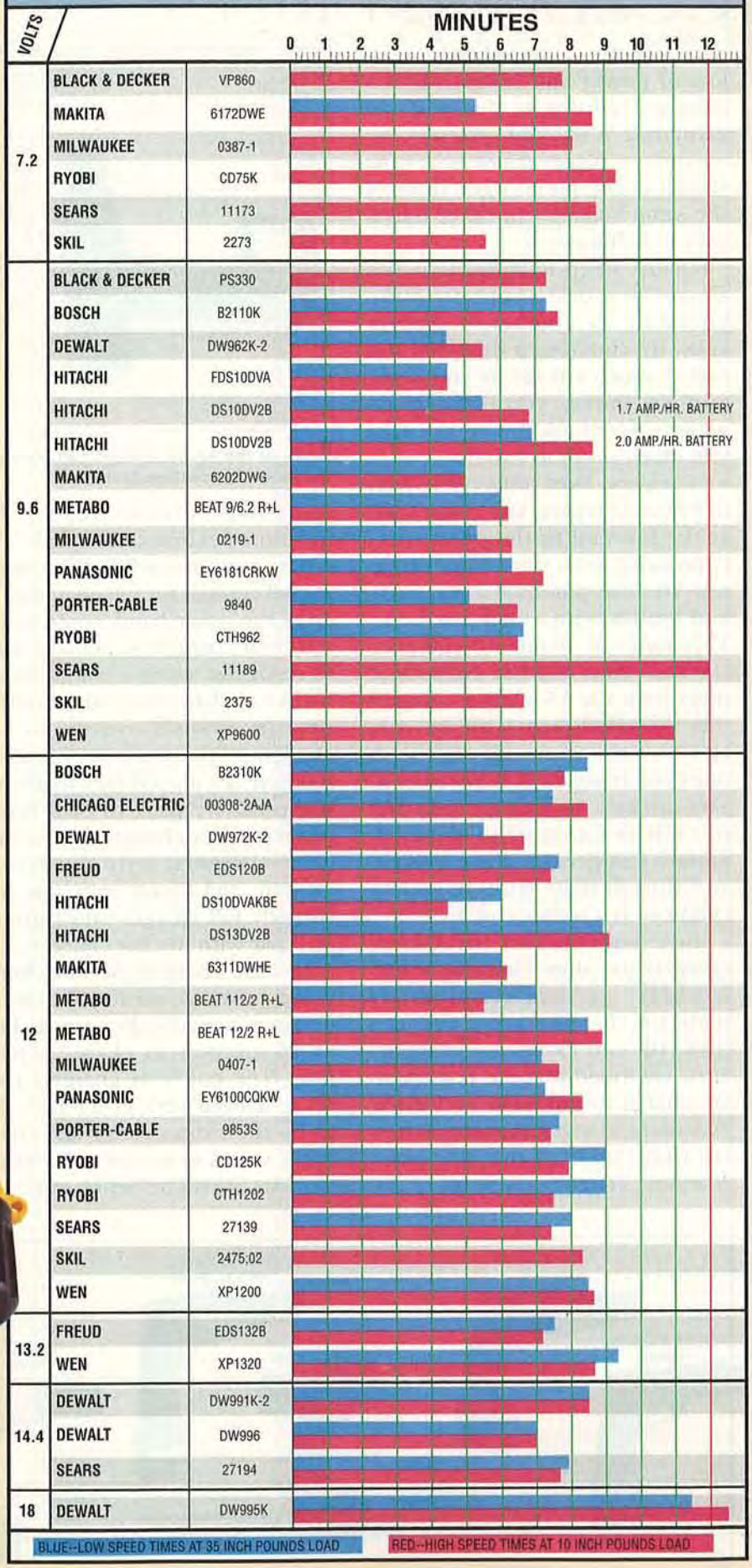
packs or the boxes that contain them. Instead, high-Ah batteries are often referred to as "high-capacity" versions. Since "high-capacity" is no more specific than "high voltage," we've listed the specific Ah ratings for each tested drill in the full-page chart.

So why do cordless drills with battery packs of the same voltage and Ah rating produce different amounts of work? Some manufacturers claim that their motors produce more work because they contain rare-earth magnets. Others say that fan cooling helps their motors run more efficiently. In our testing the fan-cooled machines *did* stay cooler. (The coolest-running models, the DeWalts, were the only ones with two fans.) In the full-page chart we list the fan-cooled models.

Also, we found out that battery manufacturers sell battery cells of various quality grades. A cordless-drill maker that puts performance before price will typically buy batteries of the highest grade.

Several manufacturers offer the same drills with pistol-grip (upper) or T-handle configurations.

RUN-TIME COMPARISONS



ness. Ideally, a drill should pack lots of power and features into a compact housing so that you can maneuver it in tight quarters. So remember, bigger *is not* better. As shown in the photo *right,* drills of the same voltage can differ drastically in bulkiness.

Finally, keep in mind that the *weight* of a drill is greatly influenced by its number of battery cells. By choosing a drill that has just as much voltage as you need, and no more, you'll keep its weight down and make the tool that much easier to handle.

Drills of the same voltage can vary greatly in size. The Panasonic drills (left) were the most compact we tested.

•Chargers. Most drills come with one-hour chargers, and some drills at the low-end of the price spectrum come with three-hour chargers. You can purchase a few high-end brands with either one-hour, 15-minute, or 10-minute chargers. (In the chart we list Panasonic drills with the 15-minute chargers that we tested them with, but you can buy the same models with one-hour chargers at a lower cost. You can buy the DeWalt units and the Porter-Cable 9840 with 15-minute chargers, and the Metabo and Hitachi units with 10-minute chargers, at a higher cost.)

Since we consider three-hour chargers too slow for most woodworkers, we concentrated our tests on the one-hour and the "fast" 10- and 15-minute chargers. First, we found that the fast chargers tended to put fuller and more-consistent charges into the batteries than most of the one-hour chargers. That's because all of the fast chargers have circuitry that monitors the heat of the pack. This circuitry senses when the battery is cool enough for full charging.

On the other hand, some of the one-hour chargers in our test failed to recognize when a warm battery had cooled to the point that the charger should switch to full charging. To avoid problems of this sort, it's a good idea to allow a warm battery pack to cool *before* placing it in a charger. Of the one-hour chargers, only the Bosch, DeWalt, and Freud units put consistently full charges into batteries on a par with the fast chargers.

Because chargers do not charge warm batteries, we found that fast chargers occasionally took as long as 35 minutes to charge a pack fully. The one-hour chargers took up to 1 hour and 35 minutes. So, given the extra cost of fast chargers, it seems to us that most woodworkers would be better served by investing in extra battery packs (one or more of which should always be cool) rather than a fast charger. Of course, if you can afford it, owning a fast charger *and* extra battery packs is the best possible way to ensure that you're never short of power.

Of the fast chargers, the Metabo version kept its batteries the coolest during charging. (Heat is an enemy of battery longevity.) Battery packs came out of the Metabo charger at a temperature of 90°. The DeWalt 15-minute charger was next coolest with 97° packs after full charging.

•High/low speeds. Technically, most of the models in this test are known as drill/drivers. This means that they have a high-speed range for drilling, and a low-speed range for driving fasteners. As you will notice in the "torque" and "total revolutions" charts, many of the drills priced under $100 have just

one speed range. This single speed range is generally a "compromise" between the ideal drilling and driving speeds. These tools are suitable for most homeowners, but if you're a serious woodworker, you'll need a model with two speed ranges. We did not find any of the single-speed models to be effective at drilling clean holes, although they work well for driving all but the largest fasteners.

• **Clutches**. Nearly all of the tested drills have at least five clutch positions plus a "drill" setting (clutch is locked up). Some Bosch, Hitachi, and Panasonic models have 15 or more clutch settings.

This mechanism automatically stops the chuck from spinning at predetermined torque levels. So, if you adjust a five-position clutch to its "1" position, the chuck will stop turning once it encounters a low workload. Set at "5", the clutch will disengage only under a heavy load. This gives you greater control over screw depth, and can prevent screw breakage. We've found that five clutch settings are sufficient for most woodworking tasks. You may find additional settings helpful if you do precision work in delicate materials such as plastics or thin softwoods.

• **Electronic speed control.** This feature helps a drill maintain consistent speed under various loads. Although many of the tested models tout this feature, the Panasonics, Hitachis, and the Milwaukee 0219-1 performed noticeably better in this area.

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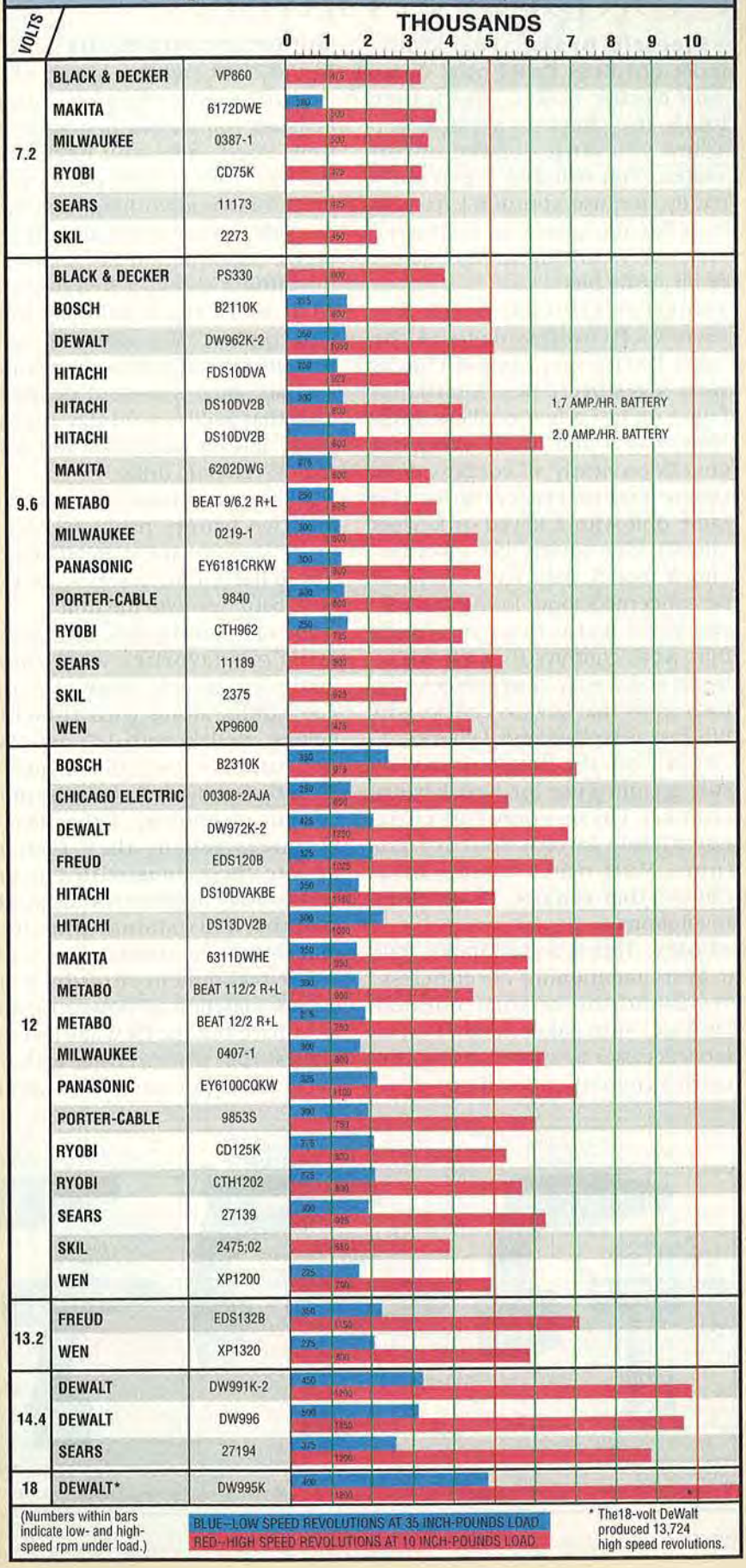
TOTAL REVOLUTIONS
A good measure of work output



CORDLESS DRILLS

• **Electric brake.** Thankfully, most cordless drills now come with electric brakes. This feature brings the chuck to a quick stop when you let go of the on/off switch. You will find it extremely handy because you don't have to wait for the chuck to stop spinning before driving another screw or changing bits.

• **Keyless chucks.** In our last review of cordless drills in the April 1991 issue, keyless chucks were a relatively new innovation found on just a few cordless drills. Now, you'll find these wonderful chucks on nearly all cordless drills (some manufacturers offer the same drill with a keyed or keyless chuck). Our advice: get a keyless-chuck model. You won't have to be concerned about losing the key, and you'll find it easier to change bits. And, contrary to what we've heard and read in many places, our tests show that keyless chucks grip bits just as well as keyed chucks.

As in 1991, the Panasonic models still get our vote for best keyless chucks. These open and close completely in only four revolutions. Most other models have chucks that require 20 or more revolutions.

• **Color.** This is a small point, but it bears mentioning nevertheless. We found the brightly colored DeWalt, Milwaukee, and Hitachi models easier to spot than the others in a cluttered workshop.

Our recommendations

In the chart *right* we group all of the drills according to voltage because you should first settle on how many volts you need. The 9.6-volt drills proved plenty powerful for woodworking, and light enough to be comfortable. If you tackle construction tasks such as building a deck, a heavier 12-, 13.2-, or 14.4-volt drill may serve you better. We see the new DeWalt 18-volt drills as best suited for tradesmen who need a cordless drill that will run all day on one pack, and for tasks typically done with ½" electric drills.

Whatever voltage you opt for, buy two battery packs so you're never short of juice. Retailers get top dollar for accessories, so buy both batteries *with* the drill.

Among both the 9.6- and 12-volt drills our favorites were those made by Bosch, DeWalt, and Panasonic, along with Hitachi's newest models with 1.7- and 2.0-Ah batteries. Not coincidentally, all of these brands feature the most current technology. Other manufacturers tell us they plan to update their lines with current technology within the next six months. This should put their models into the "hunt."

Our recommended drills were evenly matched in power for the most part, but the DeWalts had the highest rpm while staying with, or exceeding, the others in torque. We give the Bosch, Hitachi, and Panasonic models a slight edge in ergonomics. The Bosch drills have lifetime brushes, and the Panasonics were the most compact models tested.

If your budget won't allow one of these brands, keep in mind that cordless drills are a lot like computers and other electronics. You pay a premium for the latest technology (such as high-Ah batteries). But, the models with the older technology may be adequate for you. As shown by our "top-value" ratings, we came across many lower-priced models that meet the needs of many woodworkers.

Before choosing a model that costs less than $90 though, be certain that you can live with certain performance tradeoffs. Most of these drills have 3-hour chargers, single-speed transmissions, or low-Ah batteries that tire quickly.

Note: *Although the chart lists the specific models that we tested, keep in mind that some manufacturers make similar drills with slightly different features and accessories. The same drill may come with or without a keyless chuck, in T-handle or pistol-grip configuration, with one battery or two, with regular- or high-capacity batteries, or with various chargers. Each version will have a different model number, so discuss these options with your dealer.*

Written by Bill Krier Technical consultant: Bob McFarlin Photographs: William Hopkins

MORE SPECS ON TESTED CORDLESS DRILLS

VOLTS	MANUFACTURER AND BRAND	MODEL (1)	AMP. HOURS (2)	NUMBER OF BATTERIES INCLUDED (3)	CHARGE TIME (HOURS)	KEYLESS CHUCK (YES, NO)	CHUCK CAPACITY (INCHES)	CLUTCH SETTINGS	ELECTRIC BRAKE (YES, NO)	NO-LOAD SPEEDS (RPM)	LOADED SPEEDS (RPM) (4)	FAN-COOLED MOTOR (YES, NO)	LENGTH FROM TRIGGER TO CHUCK TIP (INCHES)	OVERALL LENGTH TO NOSE OF CHUCK (INCHES)	OVERALL HEIGHT (INCHES)	HANDLE STYLE (5)	DRIVER-BIT STORAGE (YES, NO)	CARRYING CASE (6)	WEIGHT (POUNDS)	COUNTRY OF ASSEMBLY (7)	SELLING PRICE (8)
7.2	BLACK & DECKER	VP860	1.2	2*	3	Y	3/8	5 + DRILL	N	0-600	0-475	Y	6	9 3/4	8 5/8	P	Y	N	2.72	M	$ 50*
	MAKITA	6172DWE	1.3	2	1	Y	3/8	--	Y	0-250, 0-600	0-200, 0-500	Y	5 1/2	9 5/8	8 1/4	P	N	P	2.80	E	110
	MILWAUKEE	0387-1	1.3	1	1	Y	3/8	--	N	0-600	0-500	N	5 3/4	9 1/2	8 5/8	P	N	N	2.52	U	N/A
	RYOBI	CD75K	1.5	2	3	Y	3/8	3 + DRILL	N	0-520	0-425	N	7 1/2	10 3/4	9 3/8	P	Y	P	2.88	C	65
	SEARS	11173	1.5	1	3	N	3/8	--	N	300, 600	0, 425	N	6	9 1/2	8 7/8	P	N	N	2.65	C	60
	SKIL	2273	1*	2*	3	Y	3/8	4 + DRILL	N	300, 600	0, 450	N	6 1/2	9 7/8	7 1/2	P	Y	N	2.50	M	55
9.6	BLACK & DECKER	PS330	1.2	1	3	Y	3/8	5 + DRILL	Y	0-700	0-600	Y	6 3/4	8 5/8	10 1/8	P	Y	N	3.04	C	70
	BOSCH	B2110K*	1.7	2	1	Y	3/8	15 + DRILL	Y	0-350, 0-1000	0-275, 0-800	Y	4	8 3/4	9 3/4	T	Y	P	3.49	S	185
	DEWALT	DW962K-2	1.7	2	1	Y	3/8	5 + DRILL	Y	0-400, 0-1200	0-350, 0-1050	Y	5	9 3/8	9 1/8	T	Y	S	4.22	U	180
	HITACHI	FDS10DVA	1.2	2	1	Y	3/8	5 + DRILL	Y	0-280, 0-850	0-250, 0-625	N	5 1/8	8 5/8	8 1/8	T	Y	P	3.28	T	130
	HITACHI	DS10DV2B	2	2	1	Y	3/8	22 + DRILL	Y	0-400, 0-1100	0-300, 0-800	Y	4 1/4	7 7/8	8 7/8	T	N	P	3.27	I	195
	MAKITA	6202DWG	1.7	1	1	Y	3/8	5 + DRILL	Y	0-350, 0-1100	0-275, 0-800	Y	4 1/2	9 1/4	9 1/2	T	N	P	3.95	J	220
	METABO	BEAT 9/6.2 R+L	1.4	1	1	Y	3/8	5 + DRILL	Y	0-300, 0-900	0-250, 0-625	N	6 3/4	9 5/8	9 1/2	P	Y	S	3.62	G	210
	MILWAUKEE	0219-1	1.3	1	1	N	3/8	5 + DRILL	Y	0-350, 0-1000	0-300, 0-800	Y	4 1/2	9	10	T	N	N	3.71	J	200
	PANASONIC	EY6181CRKW	1.7	1	15 MIN	Y	3/8	21 + DRILL	Y	0-350, 0-1000	0-300, 0-800	Y	4	8 5/8	8 3/8	T	N	P	3.56	U	165
	PORTER-CABLE	9840	1.3	2	1	Y	3/8	5 + DRILL	Y	0-350, 0-1000	0-300, 0-800	N	5	9 1/4	9 3/4	T	N	P	3.62	U	165
	RYOBI	CTH962	1.5	2	1	Y	3/8	5 + DRILL	Y	0-350, 0-1000	0-250, 0-725	Y	4 1/2	9 1/2	9	T	Y	P	3.29	C	120
	SEARS	11189	1.5	1	1	Y	3/8	3 + DRILL	N	0-600	0-500	N	7 1/2	10 3/4	10 1/4	P	Y	N	3.35	C	120
	SKIL	2375	1*	1	3	Y	3/8	4 + DRILL	N	0-700	0-625	Y	6 1/2	9 3/4	9 1/2	P	N	N	3.02	M	65
	WEN	XP9600	1.4	1	1	Y	3/8	5 + DRILL	N	300, 1100	0, 475	Y	5	9 1/8	9 1/8	T	N	N	3.24	C	80
12	BOSCH	B2310K*	1.7	2	1	Y	3/8	15 + DRILL	Y	0-400, 0-1200	0-350, 0-975	Y	4	8 3/4	10 1/8	T	Y	P	3.92	S	195
	CHICAGO ELECTRIC	00308-2AJA	N/A	1	1	Y	3/8	5 + DRILL	N	0-300, 0-900	0-250, 0-650	N	6 1/2	9 7/8	10 1/2	P	Y	P	3.74	T	90
	DEWALT	DW972K-2	1.7	2	1	Y	3/8	5 + DRILL	Y	0-450, 0-1400	0-425, 0-1250	Y	5	9 3/8	9 1/8	T	Y	S	4.54	U	190
	FREUD	EDS120B	1.4	2	1	Y	3/8	5 + DRILL	Y	0-375, 0-1300	0-325, 0-1025	Y	7 1/4	10 3/4	10 1/4	P	N	P	4.21	G	200
	HITACHI	DS10DVAKBE	1.2	2	1	Y	3/8	5 + DRILL	Y	0-400, 0-1600	0-350, 0-1150	N	5	8 7/8	10	T	N	P	4.25	I	210
	HITACHI	DS13DV2B	2	2	1	Y	1/2	22 + DRILL	Y	0-350, 0-1200	0-300, 0-1000	Y	4 3/4	9	9 3/4	T	N		4.16	I	220
	MAKITA	6311DWHE	1.7	2	1	Y	1/2	5 + DRILL	Y	0-370, 0-1150	0-350, 0-950	Y	5	9 3/4	9 1/8	T	N	P	4.53	E	205
	METABO	BEAT 112/2 R+L	1.4	1	1	Y	1/2	5 + DRILL	Y	0-300, 0-1100	0-300, 0-900	N	7 1/2	10 1/4	10 3/8	P	Y	S	4.64	G	320
	METABO	BEAT 12/2 R+L	1.4	1	1	Y	3/8	5 + DRILL	Y	0-300, 0-900	0-275, 0-750	N	6 3/4	9 5/8	10 3/8	P	Y	S	3.90	G	245
	MILWAUKEE	0407-1	1.7	2	1	Y	3/8	5 + DRILL	Y	0-350, 0-1000	0-300, 0-800	Y	7	10 1/2	10 1/2	P	N	S	3.87	U	175
	PANASONIC	EY6100CQKW	1.7	1	15 MIN	Y	3/8	21 + DRILL	Y	0-350, 0-1300	0-325, 0-1100	Y	4	8 5/8	8 1/4	T	N	P	3.82	U	200
	PORTER-CABLE	9853S	1.4	2	1	Y	3/8	5 + DRILL	N	0-350, 0-1000	0-300, 0-750	N	7 1/4	10 5/8	9 1/2	P	N	S	4.33	U	165
	RYOBI	CD125K	1.5	2	1	Y	3/8	5 + DRILL	Y	0-300, 0-1000	0-275, 0-800	Y	8	11	10 1/4	P	Y	P	3.53	C	115
	RYOBI	CTH1202	1.5	2	1	Y	3/8	5 + DRILL	Y	0-300, 0-1000	0-275, 0-800	Y	4 1/2	9 1/2	9	T	Y	P	3.58	C	150
	SEARS	27139	1.5	2	1	Y	3/8	5 + DRILL	N	0-350, 0-1000	0-300, 0-925	Y	8 1/4	11 1/2	10 7/8	P	Y	P	4.25	C	150
	SKIL	2475;02	1*	1	3	Y	3/8	5 + DRILL	N	0-700	0-650	Y	6 1/2	9 3/4	9 1/2	P	N	P	3.25	M	85
	WEN	XP1200	1.4	1	1	Y	3/8	4 + DRILL	N	0-300, 0-1100	0-225, 0-700	Y	5	9 1/8	10 1/4	T	N	N	3.59	C	90
13.2	FREUD	EDS132B	1.4	2	1	Y	3/8	5 + DRILL	Y	0-400, 0-1400	0-350, 0-1150	Y	7 1/4	10 3/4	10 1/4	P	N	P	4.31	G	210
	WEN	XP1320	1.6	1	1	Y	3/8	5 + DRILL	N	0-300, 0-1100	0-275, 0-800	Y	5	9 1/8	10 1/4	T	N	N	4.04	C	110
14.4	DEWALT	DW991K-2	1.7	2	1	Y	3/8	5 + DRILL	Y	0-450, 0-1400	0-450, 0-1200	Y	5	9 1/2	9 1/4	T	Y	S	4.81	U	225
	DEWALT	DW996	1.7	1	1	Y	1/2	5 + DRILL + HAMMER DRILL	Y	0-600, 0-1750	0-500, 0-1450	Y	8 1/4	11 3/4	9	P	Y	S	5.19	U	235
	SEARS	27194	1.7	2	1	Y	3/8	23 + DRILL	Y	0-400, 0-1400	0-375, 0-1200	Y	5 1/4	10	10	T	Y	P	4.61	C	190
18	DEWALT	DW995K	1.7	1	1	Y	1/2	5 + DRILL	Y	0-450, 0-1400	0-400, 0-1200	Y	5 1/2	10	9 1/4	T	Y	P	5.55	U	240

1996 WOOD MAGAZINE EDITORS' CHOICE TOP TOOL — BLUE BARS INDICATE TOOLS THAT PERFORMED BEST REGARDLESS OF PRICE

1996 WOOD MAGAZINE EDITORS' CHOICE TOP VALUE — RED BARS INDICATE TOOLS THAT OFFER THE BEST BLEND OF PERFORMANCE *AND* PRICE

1996 WOOD MAGAZINE EDITORS' CHOICE TOP TOOL / TOP VALUE — PURPLE BARS INDICATE TOOLS THAT EARNED BOTH AWARDS

NOTES:

1. (*) Bosch models B2110K and B2310K also labeled as models 3110K and 3310K in industrial outlets.
2. (*) Skil 1.0 AH battery packs will be upgraded to 1.3 AH in mid-'96.
3. (*) Two batteries required for operation.
4. Loads applied were 35-inch/pounds in low gear and 10 inch/pounds in high gear. Models with a single\ speed range were loaded at 10-inch/pounds.
5. (P) Pistol-grip (T) T-shaped
6. (N) None (P) Plastic (S) Steel
7. (C) China (I) Ireland (S) Switzerland (E) England (J) Japan (T) Taiwan (G) Germany (M) Mexico (U) United States
8. Lowest selling prices based on advertisements, catalogs, and manufacturer inquiries at time of article's production.

* Batteries and charger not included. Add $30 for these items

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Back-road Beauty

Scrollsaw this 3-D farm scene

Ordinary farmstead sights provide extraordinary scrollsawing pleasure in this new 3-D scene from scrollsaw artist Judy Gale Roberts. The stacked cutouts show so much detail that you can almost smell the hay.

Finishing materials we used:

Delta Home Decor gel wood stain
maple, 53215.

Delta Home Decor pickling gel
desert white, 54101
cactus green, 54103
ice blue, 54104
cranberry, 54110
goldenrod, 54115

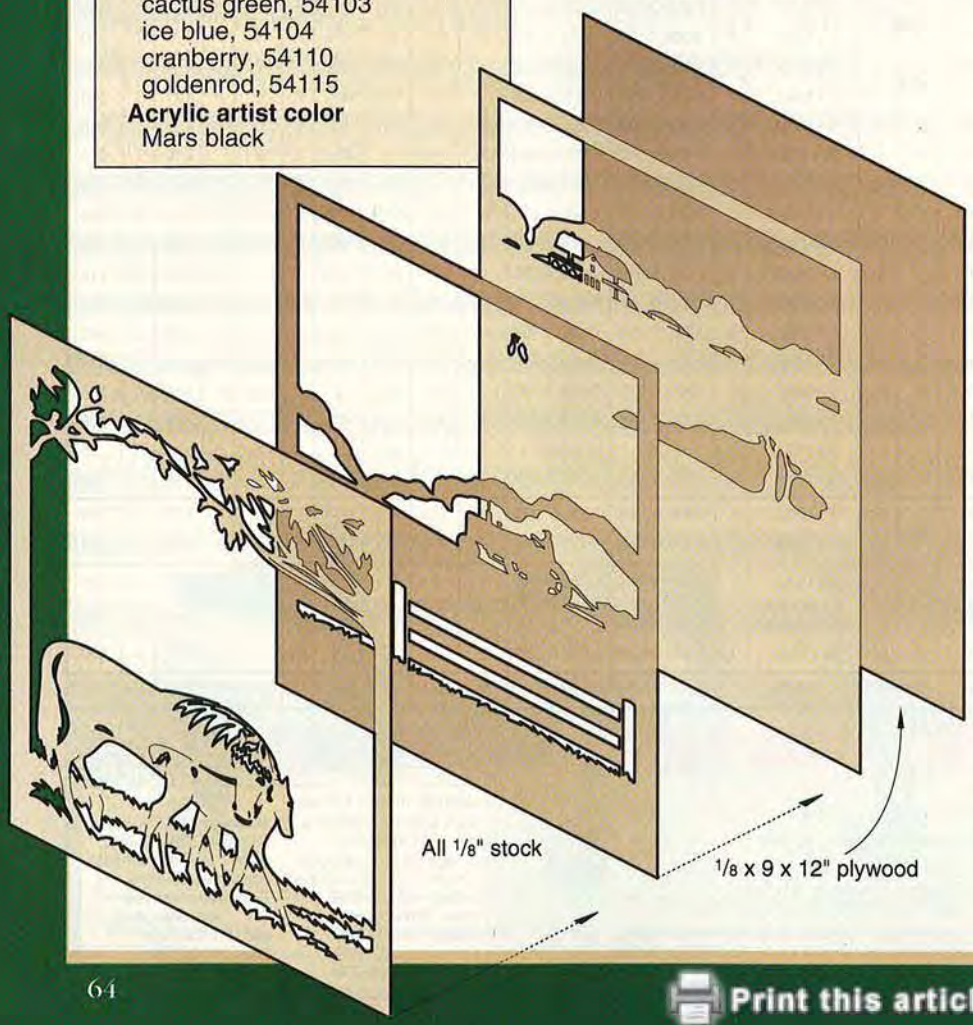
Acrylic artist color
Mars black

First, scrollsaw the scene

1 Cut four ⅛×9×12" blanks. (We used Baltic birch plywood for our painted scene. You could saw the patterns from solid stock of various woods for a different look.)

2 Photocopy the patterns in the *WOOD PATTERNS®* insert in the middle of the magazine. Adhere one pattern to each of three of the plywood blanks. The fourth blank will be the solid back.

3 Drill 1/16" blade start holes in the shaded areas of each pattern. You'll cut out these portions.



4 Select one of the patterned pieces to start sawing. (The order in which you cut the panels doesn't matter.) Insert the blade through the start hole in the smallest area. (We scrollsawed the scene using a #4 blade, .035×.014" with 18 teeth per inch.)

5 Scrollsaw the three patterned blanks. On each one, start with the smallest cutout area, and work up to the largest.

6 Sand the cutouts. Be sure to remove any fuzz from the sawn edges before proceeding.

Then, paint the panels

1 Paint each cutout panel with color washes or stains. (We used the pickling gels, gel stain, and acrylic paint listed in the box *left*, all available from craft-supply dealers. You could use thinned acrylics or watercolors instead.)

2 Color the front cutout green, except for the horses and tree branches, which receive maple stain. Apply the gelled finishes with a rag stretched over your fingertip. Rub them in to give the wood a transparent tint. Color only the face of the cutout, not the edges; the contrast provides additional dimension to the scene.

3 Stack the front cutout (we'll call it the horse panel) on the next layer in the scene (the tractor panel). Brown (maple stain) needs to show through the large horse's cutout mane, forelock, and eyes, the cutouts that separate the colt and the horse, and the cutouts under the colt's tail and on its flank. Mark these areas on the tractor panel. (We pricked marks with

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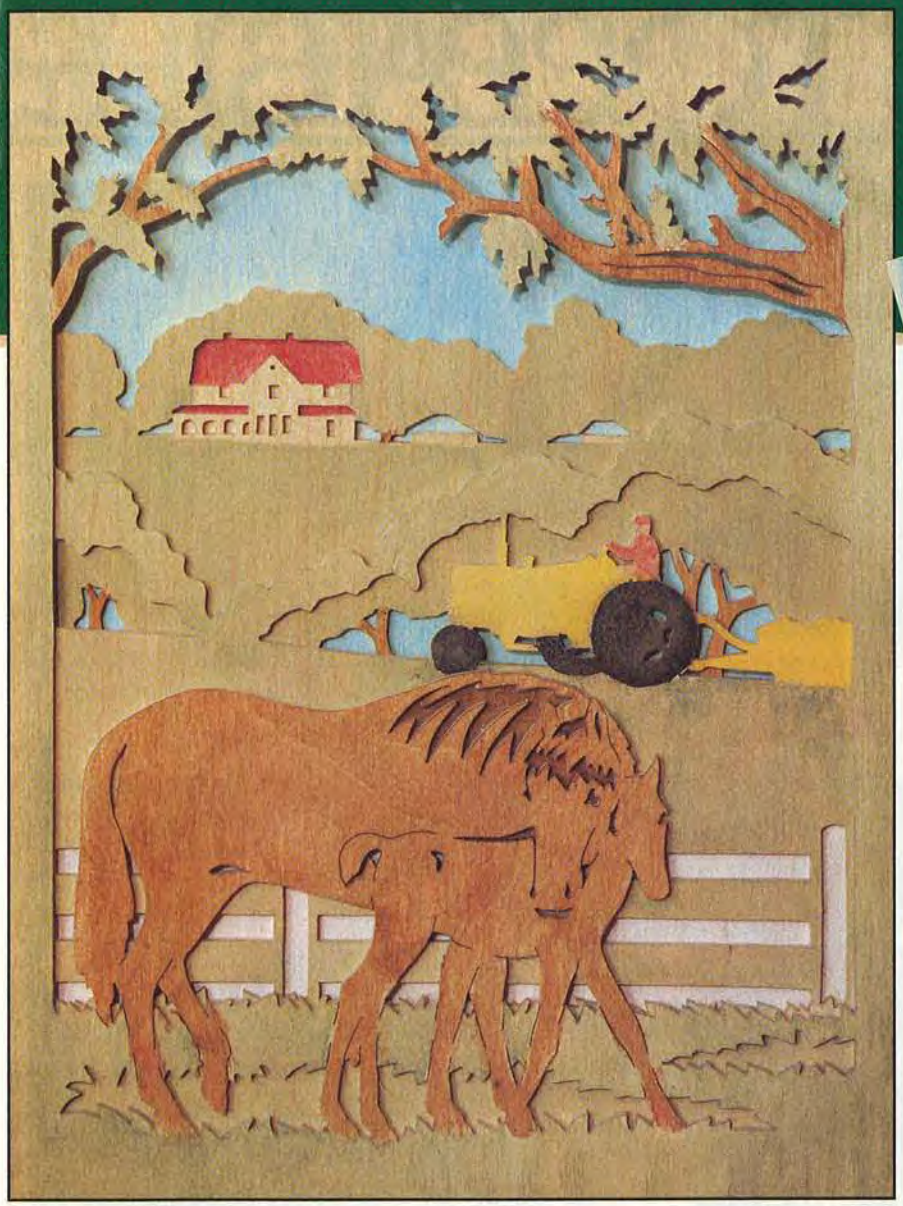

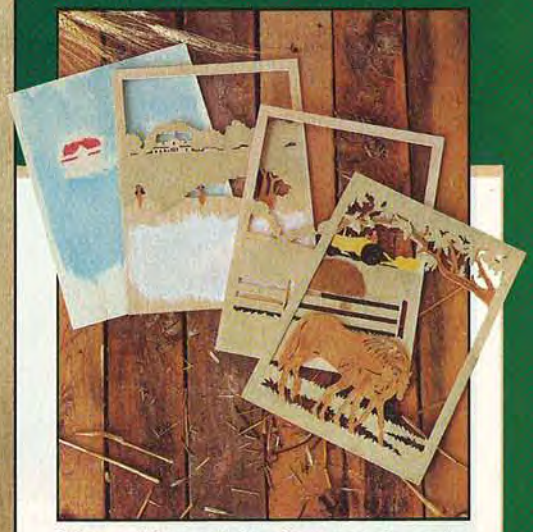

After cutting out the four panels, color them with stains, pickling gels, and paint before assembly.

a straight pin in the points on the mane and forelock, and guesstimated where the rest of the brown should go.)

4 Separate the panels. Apply maple gel stain to the marked area on the tractor panel. Restack the layers temporarily to check the color coverage.

5 Lightly pencil in the tractor tires, continuing the lines established by sawing. Stain the tractor and plow goldenrod—or your favorite farm-equipment color. Paint the tires black with thinned acrylic artist color, and paint the farmer. (We applied cranberry to his coat and hat, leaving a spot of bare wood to represent his head.) Rub green gel into the remainder of the panel.

6 Stack the tractor panel on the house panel. Mark through the fence area onto the house panel, and apply white gel there. (You could stain the house white, too; we left ours plain.) Apply maple gel to the tree trunks, then color the rest of the panel green.

7 Mark the house roof and the porch roof onto the unsawn panel. Pencil in the sides of the house. Color the roof areas cranberry, then rub in blue for the sky. (We brought our blue sky down to the row of trees behind the tractor to break up the expanse of green. If you want greater realism, paint that area green.) Leave the area behind the house plain. The panels will now look somewhat like the ones shown *above*.

8 After the stains dry, glue the panels together as shown in the Exploded View drawing. Spots of cyanoacrylate adhesive around the perimeter of each panel will hold them. After the glue cures, sand the four edges flush. You can leave the edges plain, stain them green to match the front, paint them another color, or apply moldings for a frame, as you prefer.

SEE THE *WOOD PATTERNS*® INSERT FOR FULL-SIZED PATTERNS

Buying Guide

Patterns. For information about other Judy Gale Roberts scrollsaw projects and patterns, write to:

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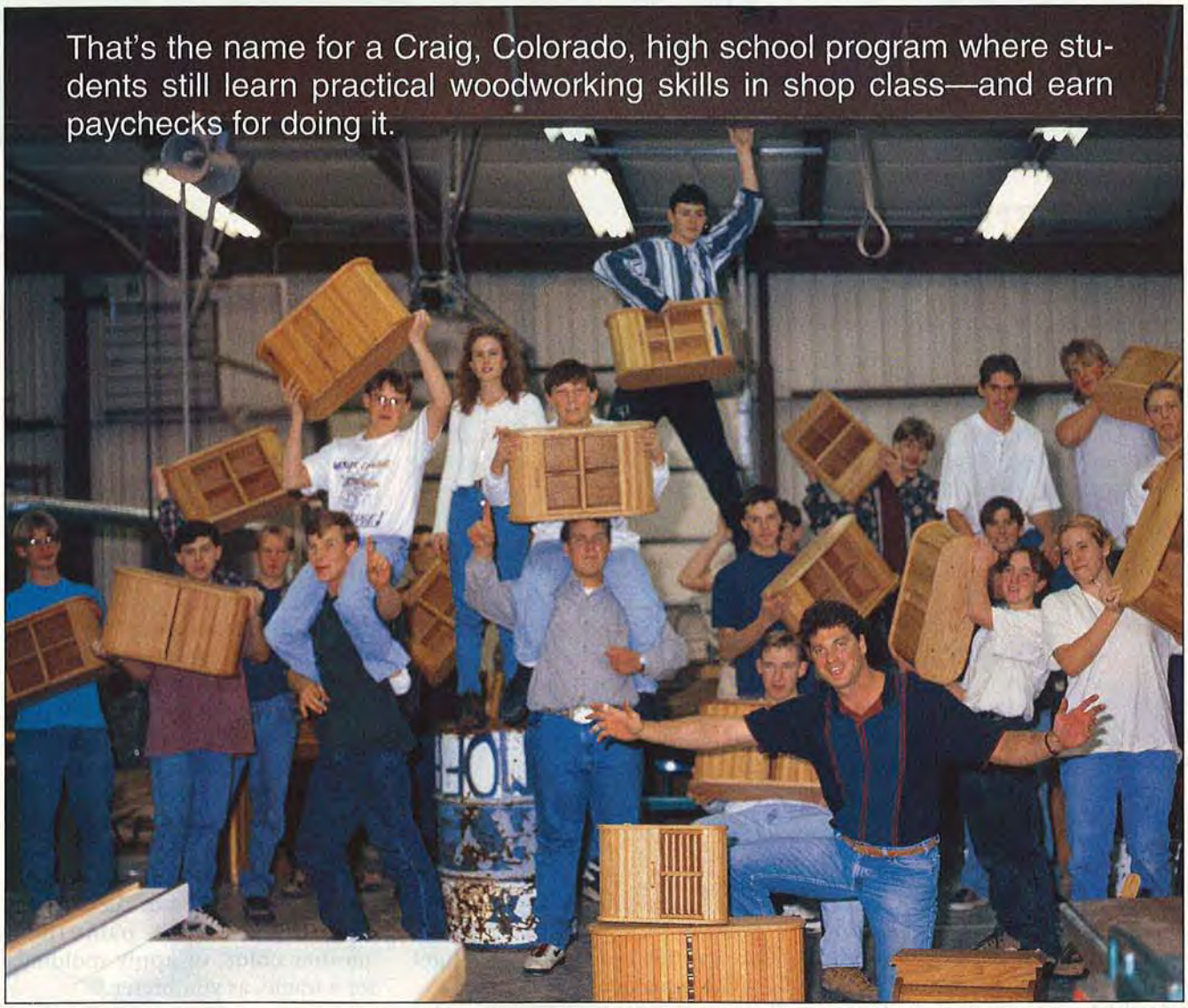
Lufkin, TX 75901.

Project Design: Judy Gale Roberts
Photographs: John Hetherington
Illustrations: Roxanne LeMoine, Lorna Johnson

"UNSTOPPABLE

That's the name for a Craig, Colorado, high school program where students still learn practical woodworking skills in shop class—and earn paychecks for doing it.



Colorado shop teacher Craig Conrad (foreground in dark shirt) echoes the enthusiasm of his Woods II shop class for their class project—the crafting and local sale of oak CD cases that raised $18,000.

Craig Conrad, a 38-year-old Colorado educator, not only saved his woodshop program by balancing its budget, but turned it into a moneymaker. Now, kids scramble to get in because they actually get paid for taking the class.

But eleven years ago, things weren't nearly so rosie. In 1985, Craig inherited a nearly defunct high school woodshop program at Craig, Colorado's Moffat County High School. Similar to today's situation in many schools, the woodshop budget was thousands of dollars in the red and enrollment had fallen off to part-time status. But Craig, himself a woodworker, not only wanted to keep his part-time teaching job, he wanted to make it full-time by pulling the program out of its skid.

Now, Moffat County High School has four different-level woodshop classes with a total enrollment of about 100 students. And the woodshop program more than carries its own weight: its students, not taxpayers, generate the funds for tool-and-material expenditures. As a bonus, industrious students even take home a paycheck of a few hundred dollars or more at the end of the term.

How has he done it? Let's take a look at how the program that Craig has dubbed "Unstoppable Shops" operates.

SHOPS"

In what the instructor calls "mini-mass production," the students produced a run of 25 CD cases to be used as samples in door-to-door selling in and around Craig, Colorado.

Buying $10,000 worth of red oak stock would put many shop programs in the red. But at Moffat County High School, there's money left over from the students' annual project sales for cash commissions, tools, and shop equipment.

They put woodshop production out on the streets

Moffat County High School's woodshop program has four year-long classes. "In Woods I, the kids learn all the woodworking basics, and use them to construct small projects," Craig explains. "I tell them that in Woods I you learn to walk, in Woods II you learn to run, because that's our production class. In Woods III we do a '2×4um,' where I have them build projects of their choice from just a length of 2×4. Then, they also do Santa's Woodshop, where before Christmas they make toys for local children. In Woods IV, students do large projects, such as cedar-strip canoes and furniture." It's Woods II, though, that generates the funds and the enthusiasm for the whole program.

Here's how Woods II works. "At the start of each year, the Woods II students vote as a class on a project that they'll make and sell," says Craig. In that vote, they take six things into consideration:

- The project's difficulty level;
- Its cost to make;
- The number of parts required;
- The availability of the necessary tools and materials required;
- How the project will sell; and
- The project's appeal to the students, so that they will really enjoy making it.

After the project has been selected, the class sets up to build some prototypes. "We call it 'mini mass production,' because it's a run of 20 to 25, just enough for every kid in the class to have a sample to sell with [see photo *opposite*]," notes the instructor. "That small run is also when we test all the jigs and fixtures we'll use on the real production run."

Over the years, Craig's classes have produced various items—folding chairs, cutting boards with knife drawers, breadboxes, whatever could be carried door-to-door. "One limitation we have is size," explains the teacher. "The kids have to haul the sample product around house-to-house to take orders, and many of the students don't have a driver's license. We could make and sell Adirondack chairs, but how would we get them door-to-door ?"

Price also is a factor in what the students produce. "We've found that about the most expensive project we can sell is $55. In our little town [population 8,000], anything over that would be getting pricey," says Craig. "Last year, the kids sold 343 portable compact-disk cases for $53.50 each."

According to Craig, the cost to build last year's oak CD case was $33.50. Taking orders for the cases door-to-door, the Woods II class generated just over $18,000 in sales, from which the students earned $5,200 in commissions. They'll get paid by spring break, when the cases will be completed to fill the orders.

"The Woods II class meets only 55 minutes a day, so when you have a magnificent order like we did this year, it's going to take until March to get them all done," Craig adds. "To do the quality of work that I require, it takes that long. But the kids understand that, and they're motivated."

Their motivation: hormones to Ho, Ho, Ho

Craig's Unstoppable Shops program has three interwoven, can't-fail elements. He likes to call them "Hormones and Money," "Fill Your Cup," and "Ho, Ho, Ho."

Continued

In his years of teaching, Craig has found that to high schoolers, hormones and money are the two greatest motivators. "They pretty much take care of the first on their own," he comments. "But the money element gets those kids out door-to-door, and that's the quickest way to sell. So I spend three whole days teaching the kids how to sell: what to say, how to say it, how to help the customer over the hurdle of indecision. You can see our sales chart just take off after they've been instructed on how to do it. In fact, I feel sorry for you if one of my students comes to your door because you're going to buy what he's selling!"

Last year's CD cases produced a profit of $20 each. Craig, however, believes in paying the students well for their efforts. So for every box sold, the student seller received a $15 commission. That meant that nearly everyone made at least $200. Some kids made a lot more. "I had one kid last year who earned $900; another one, $700 or $800," says the instructor. The remaining $5 per box Craig calls "shop profit." That goes for tools and anything else the classes need. "For lots of schools, the $1,700 we designated last year as shop profit would be their whole shop budget, and they'd be happy to have it," he says.

Because of his students' drive to sell, combined with the limited shop time available during the year to produce the items sold, Craig has to limit the number of days devoted to sales. "Last year, for instance, I limited sales days to five, yet they still went out and broke the sales record," he says.

The second element, "Fill Your Cup," has to do with individuality. "Everyone has a cup; that's their genetic makeup," he explains. "You can't control the size of your cup, you can only control how you fill it. And I've seen even physically disadvantaged kids overfill their comparatively smaller cups every day. How much my kids do is a matter of how much they want to do it."

Student Aaron Horrocks dons an elf costume for the woodshop's Christmas open house. He built the colorful biplane to give away to a local needy child. According to the shop teacher, it's important to give something back to the community.

"I had one kid last year who earned $900; another one, $700 or $800."

"Ho, Ho, Ho," Craig's third element for success, involves giving back to the community. "We [the school] take a lot from our little town and its people in the form of taxes and everything," he says. "But our woodshop program can give something back. We do that in Santa's Woodshop, where our Woods III class builds toys for local kids (see photo *above*). And these are high-quality toys that would sell for $150 in Denver—riding horses, biplanes, jets, big stuff. We decorate the shop and open it to the public for cookies and other refreshments, with the kids dressed up as elves. The next night is for presenting gifts to kids. And that all ties in with our sales program, because come next fall when one of my kids comes to the door, they'll say, 'Hey, you're the ones who gave away the wooden toys last Christmas. Sign me up."

Teachers: Want to learn more about rejuvenating your shop program?

Craig believes that traditional woodshop programs can be saved, and he'd like to help. For a booklet and information about UnStoppable Shops workshops, write with a self-addressed, stamped, business-sized envelope: Craig Conrad, Moffat County High School, 900 Finley Lane, Craig, CO 81625. Call 970/824-7036.

Written by Peter J. Stephano Photographs: Bob Ingersoll/Mi Rose Photography

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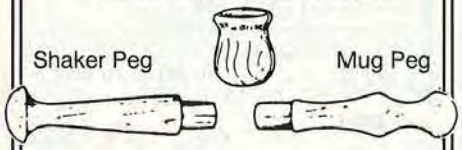

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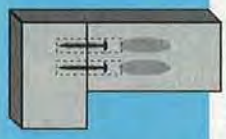

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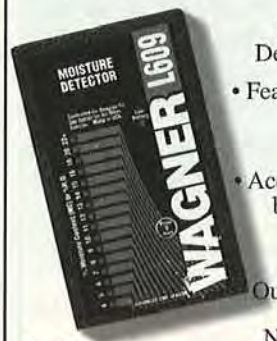

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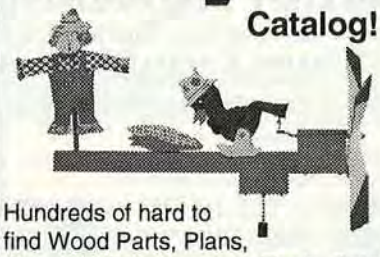

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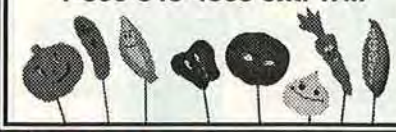

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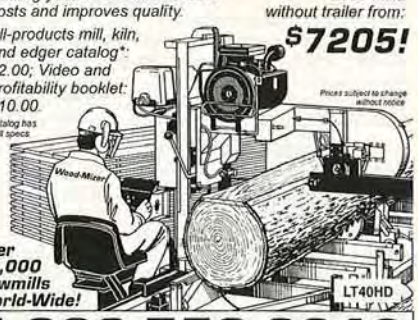

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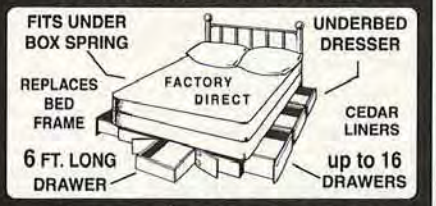

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MOUNTAIN LAUREL America's pipe wood

Along America's eastern seaboard, from Maine to Florida and inland into the Appalachians, grows a splendidly blooming small tree called the mountain laurel (*Kalmia latifolia*). In spring, its large, umbrella-shaped blossoms put those of the redbud and even the beautiful dogwood to shame.

Yet, to the local people that know it well, the mountain laurel has earned far-from-flattering names. They call it poison laurel, sheep laurel, and ivywood. That's because honey made from the mountain laurel's nectar has a nauseating smell, sharp taste, and indeed can make one ill with cramps and vomiting. For that reason, it has long been a practice of beekeepers to throw out the honey that comes from mountain laurel's blooms and await sweeter stuff. Even the tree's leaves have a poisonous effect, often causing paralysis in animals that eat them, especially foolhardy spring lambs.

And because the mountain laurel never gets really large—perhaps 30' tall in favorable red-clay soil—its wood has never attained commercial importance, except in one small way. It seems that up until the 1960s, when man-made materials became widely used, the mountain laurel furnished root burls that could be substituted for expensive imported briar in the making of smoking-pipe bowls. The wood of these burls was far heavier, harder, and denser than that in the tree above ground, making it slow to burn from smouldering tobacco.

Famed for its blossoms, mountain laurel once spawned an industry with its root burls.

Although laurel briar was said to be inferior to the imported variety, the production of pipes from it fostered a sizeable industry in the mountain communities of western North Carolina.

Illustration: Jim Stevenson

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11-950	8" Drill Press	176	128
31-050	1" Belt sander 2.0 amp	95	78
31-460	4" Belt/Disc Sander	198	129
40-560	16" 2 speed Scroll Saw	230	175
11-990	12" Bench Drill Press	255	184
11-090	32" Radial Bench Drill Press	405	315
43-505	1/2" Bench Router/Shaper	398	305
22-540	12" Bench Top Planer	Sale	385
36-220	10" Compound Mitre Saw	294	219
28-185	Bench Band Saw	213	185
28-190	NEW 12" Band Saw	497	399
40-640	20" Bench Scroll Saw	466	295
37-070	NEW 6" w/spd Bench Jointer	351	259
14-650	Hollow Chisel Mortiser	380	285
46-700	12" Wood Lathe	575	479
33-990	10" Radial Arm Saw	981	769
33-055	8-1/4" Sawbuck comp w/legs	846	665
36-040	8-1/4" Compound Mitre Saw	190	149
36-905	30" Unifence	346	249
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36-755	10" Tilting Arbor Saw	1398	1095
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33-060	"Sidekick" Miter Saw	541	399
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LU73M010	Cut off	10" 60	84	45
LU87M010	Thin Kerf	10" 24	72	44
LU88M010	Thin Kerf	10" 60	88	49
LU98M010	Ultimate	10" 80	128	68
LU91M010	Compnd Mitre	10" 60	88	54
F410	Quiet Blade	10" 40	95	49
F810	Quiet Blade	10" 80	135	74
TK303	7-1/4" Finishing	40	38	25
TK906	10" Combo	50	53	32
SD308	8" Dado - Carbide		230	119
SD506	6" carbide w/case & shims		292	155
SD508	8" carbide w/case & shims		344	168
F10	2-1/8" x 3/4" Biscuit 1000 Qty		43	29
F20	2-3/4" x 1" Biscuit 1000 Qty		45	29
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9820-2	Blade Sharpener	433	215
N1900B	3-1/4" Planer with case	263	132
N9514B	4" Disc Grinder 4.6 amp	118	65
B04552	1/4 sheet Pad Sander w/bag	101	55
DA3000R	3/8" Angle Drill	355	175
2708W	8-1/4" Table Saw	637	309
6405	3/8" Drill Rev. 0-2100 rpm	115	65
6510LVR	3/8" Drill Rev. 0-1050 rpm	188	98
6013BR	1/2" Drill Rev. 6 amp	270	145
9401	4" x 24" Belt Sander w/bag	458	219
5007NB	7-1/4" Circular Saw 13 amp	242	124
5007NBK	5007NB Saw w/ plastic case	250	129
LS1011	10" Slide Compound Saw	995	479
LS1211	12" Slide Cmpd Saw	1620	789
3901	Plate Joiner Kit	376	205

SENCO AIR NAILERS

SFN1+	Finishing Nailer 1" - 2" w/ case	448	345
SN325	Nailer 1-7/8" - 3-1/4"	665	419
SLP20	New Pinner w/cse 5/8 -1-5/8"	422	278
SKS	Stapler 5/8" - 1-1/2"	390	275
SN70	Fram. Nailer Clip Hd 2"-3-1/2"	725	459
SN60	Fram. Nailer-Full Hd 2"-3-1/2"	708	449
SN65	15% more power than SN60	709	479
SFN40	NEW Finish Nailer 1-1/4 - 2-1/2	569	389

BOSTITCH AIR NAILERS

N80S-1	Stick Nailer	Super Sale	339
RN45	Coil Roof Nailer 3/4 - 1-3/4	845	369
N60FN-2	Finishing Nailer	557	335
BT35-2	Brad Tacker 5/8" - 1-3/8"	254	155
BT35-2K	BT35-2 w/ case, oil, & brads	279	165
CWC100	1 HP Pancake Compressor	440	289
MIIIFS	Flooring Stapler 15 gauge	902	529
S32SX-1	Finish Stapler - 1/2" - 1-3/8"	245	155
S32SX-1K	S32SX-2 with case & oil	269	165

SKIL TOOLS

2735-04	12 volt cordless Drill Kit	260	148
2736-04	2735-04 with keyless chuck	269	148
77	Famous 7-1/4" Worm Drive Saw	Sale	144
77M	NEW 77 Mag Worm Saw - 2 lbs lighter than Model 77	Sale	165

PANASONIC CORDLESS

EY6181CRKW	9.6V Drill Kit w/ 2 batteries, 1 hour charger, & case	307	169
EY6181EQK	9.6 volt Drill with 15 min. charger, case & Ironman battery	315	175
EY6100CRKW	12 volt Drill Kit with 2 batteries, 1 hour charger, & case	379	188
EY6100CQKW	Same as EY6100CRKW but has 15 minute charger	409	209
EY6100EQKW	12 volt Drill kit with 2 Ironman batteries, 15 min. charger, & case	379	199
EY6101SQK	12 volt 1/2" Drill w/ 15 min. charger, diagnostic battery, & case	438	249

PASLODE IMPULSE GUNS

IM250	Trimpulse Finish Nailer Kit	1130	548
IM325	Impulse Framing Nailer Kit	1130	548

CLAYTON OSCILLATING SPINDLE SANDERS

140	Portable sndr w/ 4-1/2" spindle	625	559
146	Portable sander w/ 9" spindle	685	609
100	Floor mount sndr 4-1/2" spindle	785	709
106	Floor mount sander 9" spindle	845	759

DEWALT TOOLS

Model	Description	List	Sale
DW364	7-1/4" Circ. Saw w/brake	294	158
DW610	1-1/2 HP 2 handle Router	266	152
DW411	1/4 sheet Palm Sander	88	58
DW100	3/8" Drill, 4 amp,0-2500 rpm	118	68
DW682K	Biscuit Joiner with case	448	219
DW705	12" Compound Mitre Saw	734	359
DW625	3 HP var. spd PlungeRouter	Sale	275
DW675K	3-1/8" Planer with case	292	164
DW431	3 x 21 v/spd Belt Sander	338	184
DW421	5" Palm Random Orbit Sander	144	79
DW444	6" Ran Orb Sander-PSA pad	266	139
DW443	DW444 w/hook & loop pad	266	139
DW673K	NEW Laminate Trimmer Kit	364	215
DW935K	NEW 14.4V 5-3/8" Trim Saw Kit	444	237

DW935K comes with two batteries!

DEWALT CORDLESS DRILLS

DW952K	3/8" v/spd w/two 9.6V batt	284	139
DW962K-2	3/8"v/sp w/two 9.6V XR batt	330	179
DW972K-2	3/8"v/sp w/two 12V XR batt	362	189
DW904	12 volt flashlight	48	29.95

DW972K-2 drill & **DW904** flashlight **Sale 205**

DW991K	3/8"v/sp w/one 14.4V XR batt	388	199
DW991K-2	above drill w/ 2 batteries	Sale	225
DW994KQ	1/2" v/spd w/1 14.4V XR batt	458	235
DW994KQ-2	Above drill w/ 2 batteries	Sale	259

Above drill kits come w/ charger & steel case!

DW991KS-2	DW991K drill, DW935 trim saw, & case	Sale	349

HITACHI TOOLS

C8FB2	8-1/2" Slide Compound Saw	1169	489
C10FC	10" Mitre Saw	533	209
C10FS	10" Slide Compound Saw	1627	739
P12R	12-9/32" Planer	1688	795
P12RA	Planer/Joiner	2203	995
G12SA	4-1/2" Grinder 6.9 amp	177	79
NR83A	Fram Nailer 2 - 3-1/2 Full Head	900	399
NR83AA	Framing Nailer 2 - 3-1/2	922	425
NT65A	16 ga. Brad Nailer 1 - 2-1/2	749	345
NV45AB	Coil Roofing Nailer 7/8 - 1-3/4	935	399

BIESEMEYER FENCES

B-50	50" Commer. Saw Fence	443	329
T-SQUARE 52	52" Homeshop Fence	360	269
T-SQUARE 40	40" Homeshop Fence	335	249
T-SQUARE 28	28" Homeshop Fence	325	239

JORGENSEN ADJUSTABLE HANDSCREWS

Item#	Jaw Length	Open Cap	List	Sale	Box of 6
#0	8"	4-1/2"	20.35	12.10	66.95
#1	10"	6"	23.30	12.90	71.95
#2	12"	8-1/2"	26.75	14.90	83.95

PONY CLAMP FIXTURES

Model		List	Sale	Lots of 12
50	3/4" Black Pipe Clamps	15.45	8.10	92.50
52	1/2" Black Pipe Clamps	12.65	6.95	74.95

BOSCH

Model	Description	List	Sale
1587VS	Top Hand "CLIC" Jig Saw	292	149
1584VS	Barrel "CLIC" Jig Saw	288	149
	Bosch Metal Case for above Jig Saws	34	32
	Bosch 30 blade assortment for Jig Saws	28.99	

1584VS or 1587VS

with steel case and 30 Bosch blades **Sale 189**

3270DVS	3" x 21" v/spd belt sander	301	165
1276D	NEW 4" x 24" Belt Sander	379	219
1275DVS	NEW 3" x 24" v/spd Belt Sndr.	379	219
1276DVS	NEW 4" x 24" v/spd Belt Sndr.	408	229
1347AK	4-1/2" Grinder w/cs & access.	172	105
1194VSR	1/2" var. speed Hammer Drill	272	155
1194VSRK	above Hammer Drill w/case	303	169
1604A	1-3/4 HP 2 Handle Router	269	142
1604AK	same as above w/cse & acc	337	185
1613EVS	2HP v/spd Plunge Router	369	199
1615EVS	3 HP v/spd Plunge Router	536	298

1613EVS & 1615EVS come with FREE RA1051 Deluxe Router Guide !

1634VSK	NEW Recip Saw 10.5 amp	335	159
3300K	NEW 12V Drill Kit w/ 2 batt	285	169
3310K	NEW 12V T-handle Drill Kit	345	189
3107DVS	NEW 5" Random Orbit Sander	165	98
3107DVSK	3107DVS with case	195	115
3725DVS	NEW 5" Random Orbit Sander	256	149
3727DVS	NEW 6" Random Orbit Sander	266	154
B3915	NEW 10" Slide Compund Saw	1050	619
B1650K	Biscuit Joiner	286	169
B7000	Corner Detail Sander	126	68
B7001	B7000 w/ variable speed	Sale	89.95
B4050	In Line Jig Saw	206	119
11230EVS	SDS-max 1-1/2" Rtry Hmr	910	539
11231EVS	SDS-max 1-3/4" Rotary Hmr	1363	815
11223EVS	NEW SDS-max 2" Rotary Hammer	1595	945
11224VSR	7/8" SDS Rotary Drill	404	229

MK TILE SAWS

MK770	1/2 HP - 7" blade	795	579
MK660	3/4 HP - 7" blade	795	589
MK880	1 HP - 8" blade	986	859

AIRY AIR NAILERS

0241SK	Brad Nailer 3/8"-1 9/16"	180	96
0250SK	Brad Nailer 3/4"-2"	296	164
0626SK	1/4" Crown Stapler 3/8"-1"	194	104
0645	1/4" Crown Stapler 3/4"-1-9/16"	310	175
EZ-1	Multi-purpose nailer & stapler	180	98

Above Nailers come w/case, fasteners, oil & wrenches

0565T	Angle Finish Nailer 1"-2-1/2"	386	205

PORTA NAILER

401	Porta Nailer complete	295	209
501	Face Nailer complete	295	209

DAVID WHITE

LP6-20	Sight Level package - 20x	329	215
LP6-20XL	LP6-20 w/9056 tripod & 7620 rod	375	275
LT8-300	Level Transit - 26x	739	489
LT8-300P	above Level w/optical plum	869	565
LT6-900	Level Transit - 20x	419	269
ALT6-900	Automatic Level - Transit -18x	666	429
ALTP6-900	above Level w/tripod & rod.	799	499
ALP6-18HD	above Level w/tripod & rod	599	395
LL100	NEW Finish Line Laser Level	199	135

RYOBI SPECIALS

RE600	3 HP Plunge Router	500	228
BE321	3" x 21" var. spd Belt Sander	310	148
BT3000	10" Table Saw with stand	1125	529
AP12	12" Bench Planer	684	389
OSS450	Oscillating Spindle Sander	340	159
DC500	Detail Carver	120	64
HT20VSK	NEW Multi Tool	115	59
CD125K	NEW 12V cdlss Drill w/ 2 batt.	175	109

SIOUX TOOLS

8030	3/8" var/spd Drill	263	145
8000	3/8" var/spd close qtr Drill	211	125
690	5" Air Random Orbit Sander	228	132
Msxe6362FE	IN Triangle Sander v/spd	Sale	205
Msx625 FEIN	New Air Triangle Sander	Sale	189
LPN672 PONY	Air Palm Nailer w/glove	Sale	94.99
RTM01 ROTOZIP	Drywall cut out unit	Sale	68.95

QUAL-CRAFT PRODUCTS

2200	Pump Jack	79	58
2201	Pump Jack Brace	30	20
2203	Pump Jack guard rail holder	31	23
2204	Workbench & rail holder combo	53	39

Buy any 6 (can be assort.) deduct 10%

2601	Wall Jack	167	108

Lots of 4 deduct additional 10%

PORTER CABLE

9444	New Profile Sander Kit	220	119
7499	Ultimate Cut-out tool	119	69
690	1-1/2 HP Router 8 amp	278	142
9690	690 Router w/ steel case	309	159
691	1-1/2 HP Router D-handle	303	158
693	1-1/2 HP Plunge Router Base	338	178
6931	Plunge Router Base	139	79
695	1-1/2 HP Router/Shaper	418	229
696	Heavy Duty Shaper Table	238	135
351	3" x 21" Belt Sander w/o bag	302	159
352	3" x 21" Belt Sander with bag	312	165
352VS	3x21 Belt Sander w/bag v/spd	321	169
360	3" x 24" Belt Sander with bag	397	198
361	3" x 24" Belt Sander w/o bag	377	194
362	4" x 24" Belt Sander with bag	412	205
97751	1/2" v/spd Hammer Drill w/cse	274	158
9118	Porta Plane Kit 7 amp	400	229
505	1/2 sheet Pad Sander	249	128
7549	Top handle Jig Saw 4.8 amp	254	145
97549	7549 jigsaw w/ case & blades	275	148
330	Speed Block Sander 1/4 sheet	120	62
556	Biscuit joiner w/5556 tilt fence	Sale	139
345	6" Saw Boss 9 amp	207	109
9345	345 comp. w/cse & carb blde	237	128
9647	TIGER CUB Recip. Saw	230	124
9637	Full var/spd Recip Saw 8 amp	276	148
7519	3-1/4 HP Router 2 Handle	469	244
7518	3-1/4 HP 5 speed Router	534	275
7539	3-1/4HP v/spd Plunge Router	534	269
7310	5.6 amp Laminate Trimmer	176	98
97310	Laminate Trimmer Kit comp	336	198
7335	5" Rndm Orbit Sndr w/ case	254	135
97355	7335 w/ case & dust pick-up	274	154
7336	6" Rndm Orbit Sander w/ case	259	139
97366	7336 w/ case & dust pick-up	284	158
73333	Dust Collection system	31	24.50
9853K	12V 3/8" Drill Kit w/ 2 batt	305	164
9855	12V 1/2" 2 spd,v/sp Drill Kit	310	178
8500	12V battery for above drills	Sale	45
332	Palm Grip Rndm Orbit Sander	133	74
333	above Sander with dust bag	148	79
334	333 Sander with PSA pad	148	79
550	Pocket cutter with case	352	185
7700	10" "Lazerloc" Mitre Saw	740	345
310	Production Laminate Trimmer	270	145
347	7-1/4" "Framers" Circ Saw	230	129
347K	347 Saw w/ plastic case	250	134
743	347 Saw - left hand version	230	129
743K	743 Saw w/ plastic case	250	134
9743	743 Saw with case	260	144
447	347 Saw with brake	259	139
843	447 Saw-left hand version	259	139
7800	Drywall Sander	589	335
7810	Wet/Dry Vac for above sander	452	259
9737	New Tiger Recipro Saw	307	165

New Porter Cable Pneumatic Nailers

BN125	Brad Nailer -18 ga. 5/8"- 1-1/4"	144	99
BN200	Brad Nailer -18 ga. 3/4"-2"	238	145
FN200	Finish Nailer -16 ga. 3/8"-2"	270	165
FN250	Finish Nailer -16 ga. 1"-2-1/2"	362	225
DA250	Angle Nailer -15 ga. 1-1/4"-1-1/2"	412	249

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Print this article

Woodworkers' response to environment on display

Beginning this September, you can view projects built by skilled woodworkers who responded to a worldwide environmental challenge. "Conservation by Design" exhibits 36 pieces that display the functional and sculptural use of recycled, salvaged, and reconstituted wood, as well as lesser-known or undervalued species. It opens September 13 at the Smithsonian Institution's Renwick Gallery in Washington, D.C. The innovative exhibit runs through January 12, 1997.

Woodworkers from the U.S., Canada, England, and Australia were asked by the Woodworkers Alliance for Rainforest Protection to create objects that demonstrate responsible use of temperate and tropical woods. For example, the wine cabinet *below*, by Oregon's John Shipstad, uses chantaquiro, sucupira, and other lesser-known species, plus madrone from Oregon. For more exhibit information, call 202/357-2247.

This 32×31¼×19" wine cabinet by Oregon woodworker John Shipstad is part of the environmentally focused woodworking exhibit "Conservation by Design" at the Smithsonian's Renwick Gallery in Washington, D. C.

For safety, follow the adventures of Goggleman

Power tool safety usually isn't much fun to read about. At least that was the case before Goggleman came along.

Goggleman is the comic-book character created by the Power Tool Institute to carry credos of safety to shop-class students. But the upbeat graphics and situational humor in its 26-page, color publication, *The Adventures of Goggleman*, provide meaningful lessons for anyone new to power tools at home or in the workshop.

Get the comic book alone or an entire teaching packet that includes a lesson-planning and reference guide to power-tool safety. The Power Tool Institute (PTI), a not-for-profit trade association of power-tool manufacturers, is engaged in public education on the use of power tools. For a free copy of the comic book or packet, write: Power Tool Institute, 1300 Sumner Ave., Cleveland, OH 44115-2851.

Beat the deadline!

September 1 is the deadline for entries in the 1996 Build-A-Toy® contest, and you can still make it, if you hurry. For contest rules and prize listing, see the October 1995 issue of *WOOD®* magazine or write: Build-A-Toy, *WOOD* Magazine, 1912 Grand Ave., Des Moines, IA 50309-3379. FAX 515/284-2115.

One more gift from Mother Nature's medicine cabinet

The medical war on cancer continues, now with the help of the ever-useful birch tree (*Betula papyfirus*). Laboratory researchers at the University of Illinois have found that a chemical compound in the tree's white bark shrinks skin-cancer tumors in mice more effectively than the drug normally used to treat the disease. Human testing hasn't yet begun.

Yew, yew, and yew

During the Middle Ages in Europe, England's yew tree (*Taxus baccata*) provided the wood for the longbows used in defeating French armies. In the United States, the bark from the Pacific Northwest's yew tree (*Taxus bevifolia*) became famous as an antitoxin useful in treating cancer.

But according to Walter Overton, writing in the book *Southland Sketches*, there's another yew, one very few know about. The Florida yew (*Taxus taxifolia*) grows naturally only along the east bank of the Apalachicola River. For centuries, writes Overton, Indians of the Southeast traveled there to gather the isolated wood that they treasured for their bows. Otherwise, this little-known and thinly represented yew species has not been commercially disturbed.

Photograph: Scott Landis Illustrations: Jim Stevenson

THEY

Sand

Buff

Cut

Grind

Polish

Scrape

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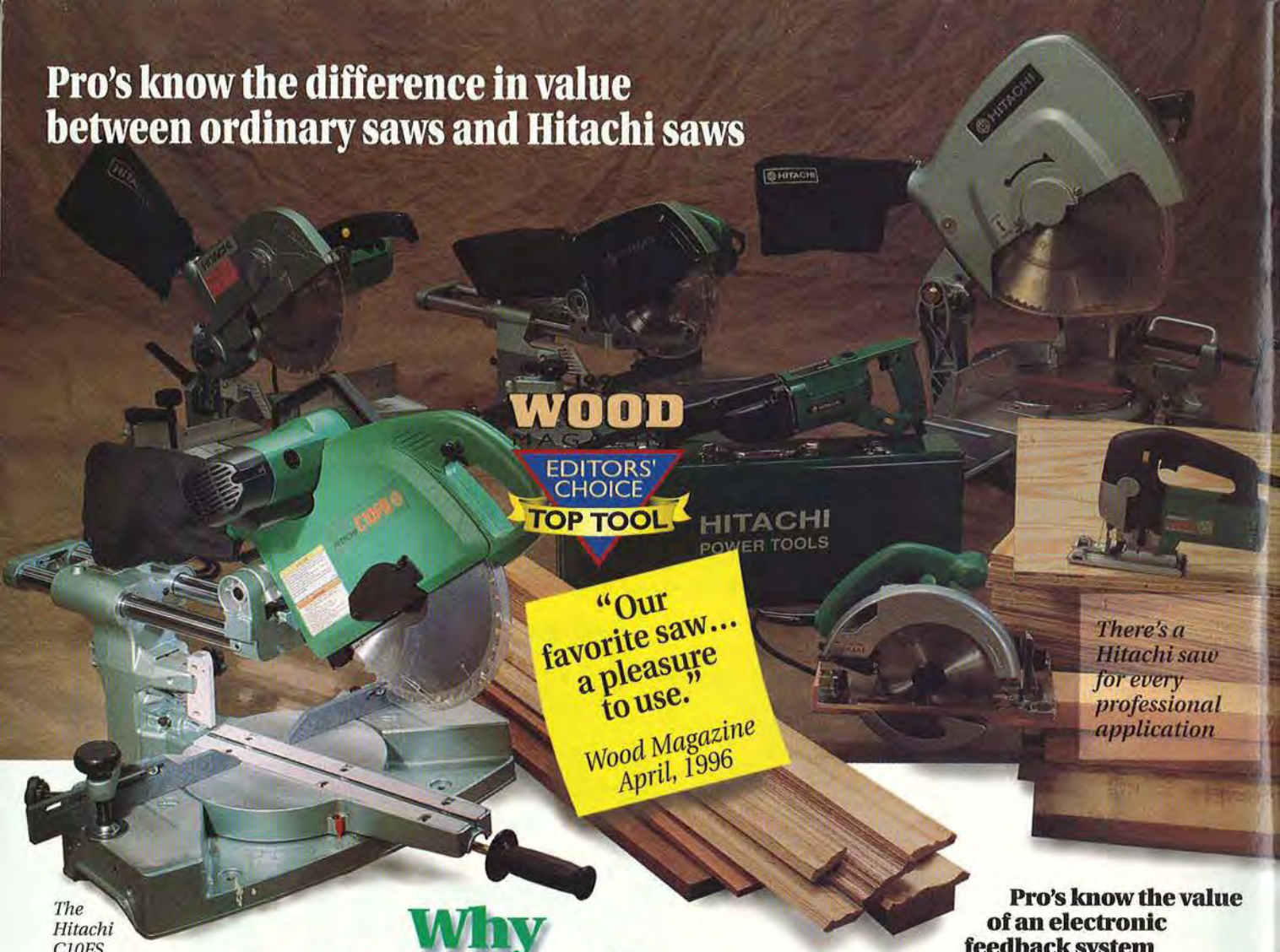
Pro's know the difference in value between ordinary saws and Hitachi saws



The Hitachi C10FS Dual Slide Compound Saw

Why professionals choose the NEW Hitachi dual slide compound saw

Pro's know the benefits of dual beveling

In fact, nothing compares to the speed and accuracy of the **Hitachi dual slide compound saw.** With its ability to make both left *and* right bevel cuts by simply "flipping" the cutting head, it makes complex crown molding work easy. The annoying need to keep track of *which side of the molding is next to the fence* is, simply, ELIMINATED. Plus, the C10FS provides *everything* you need in a compound saw with the accuracy you can *only* achieve with a Hitachi.

For example: It can easily cut a 4x4 at angles up to 45 degrees or crosscut 12" material, perfectly.

Pro's know the importance of a twin-rail slide system

Only a *heavy-duty* slide system can provide the stability needed to make accurate, repeatable cuts—with its 1-1/8" stainless steel *twin-rails,* the Hitachi C10FS has the strongest slide system in the business. It can repeat the same *exact* cut for you, time and time again—even after thousands of cuts.

Pro's know the value of an electronic feedback system

With the Hitachi C10FS, you get an advanced feedback system that maintains a constant blade speed, *even in dense materials.* Plus, its electronic controls give you a "soft" start which reduces the effect of recoil—a source of damage with *ordinary* saws—*and* it minimizes start-up noise.

And, as a pro, you can't afford anything less

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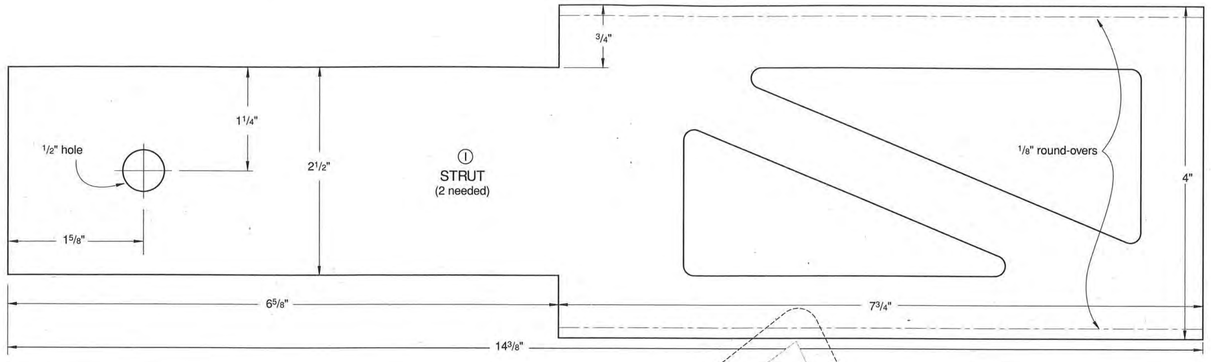

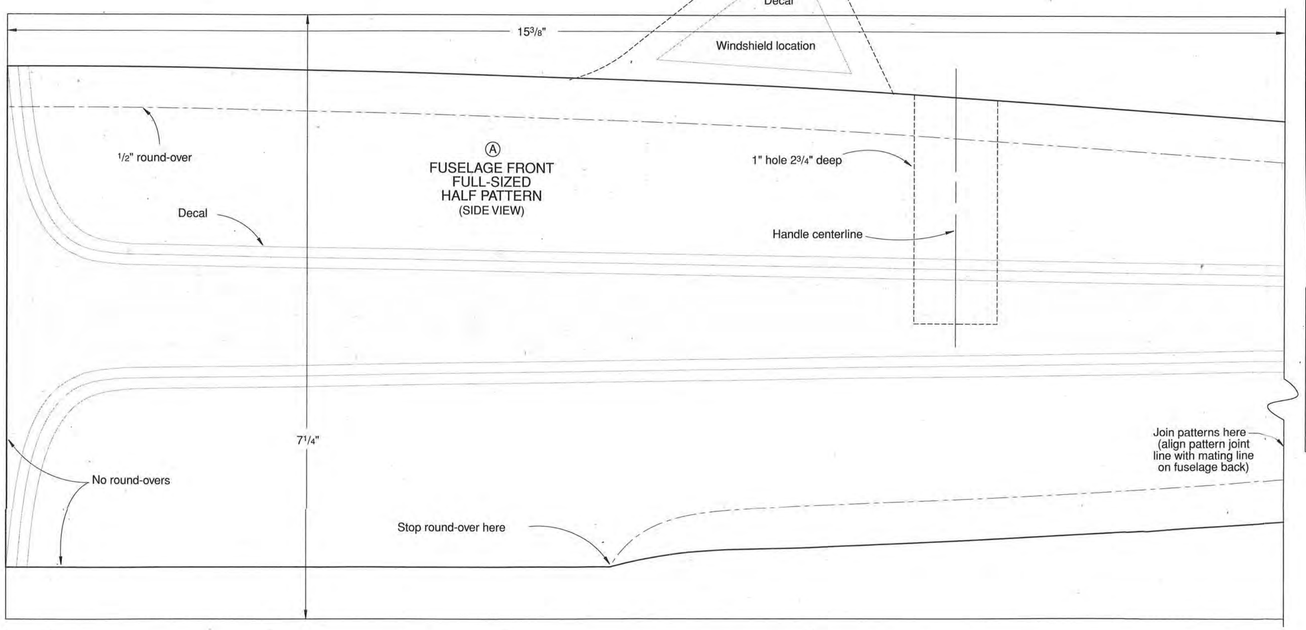

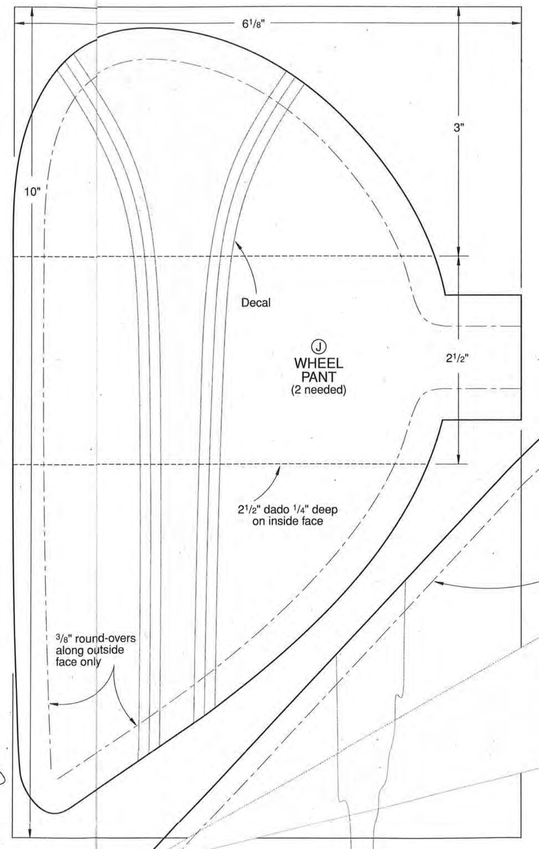

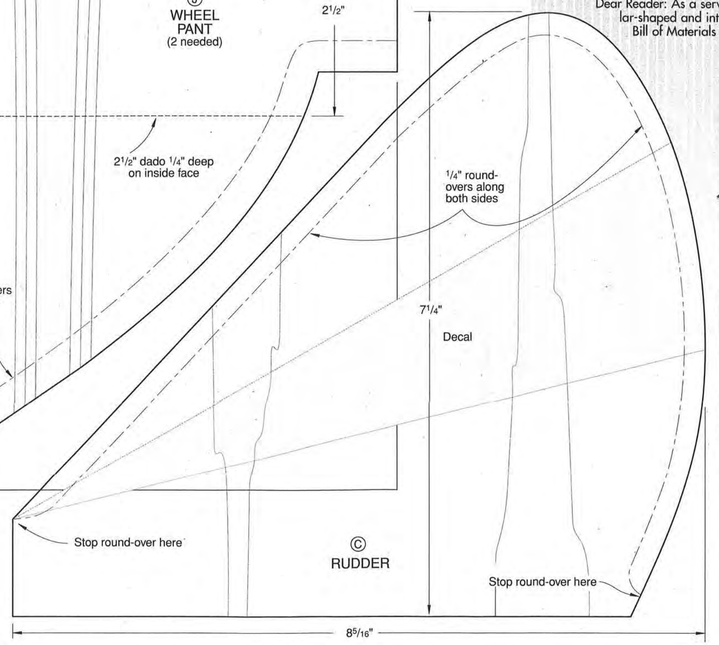

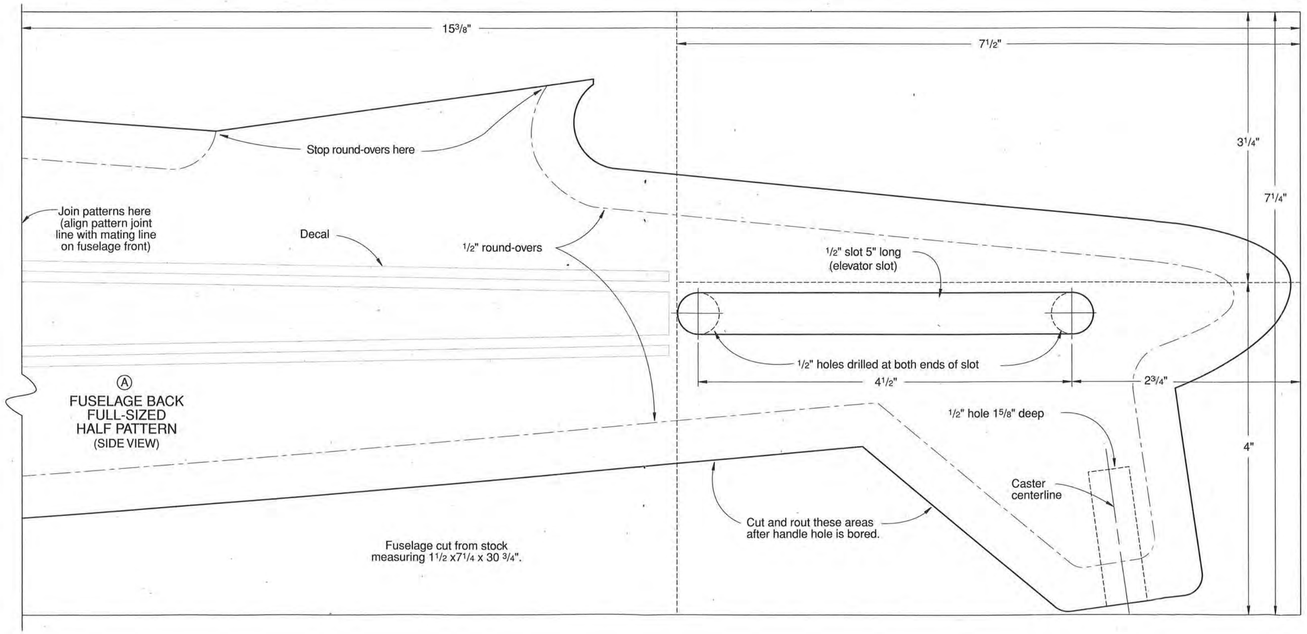

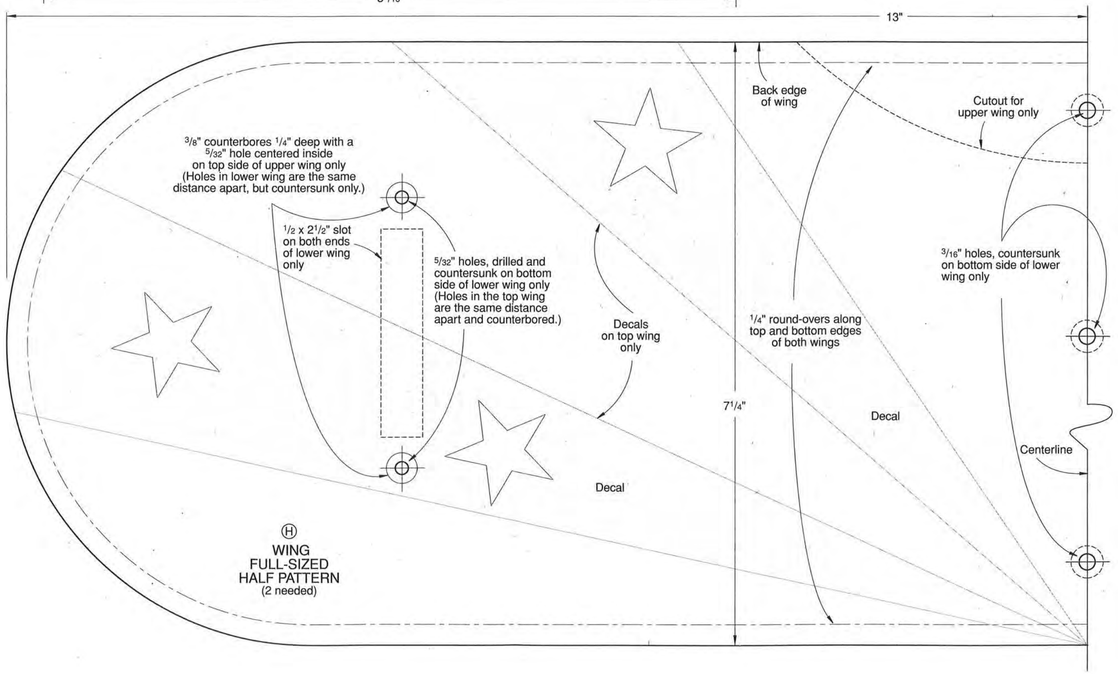

Better Homes and Gardens®
WOOD® PATTERNS™
Full-sized for your woodworking convenience

AUGUST 1996 **ISSUE 89**

Dear Reader: As a service to you, we've included full-sized patterns on this insert for irregular-shaped and intricate project parts. You can machine all other project parts using the Bill of Materials and the drawings accompanying the project you're building.

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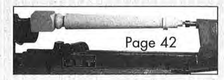

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- Kitchen table leg
- Barnstormin' biplane
- Back-road beauty
- Kaleidoscope

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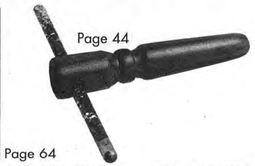

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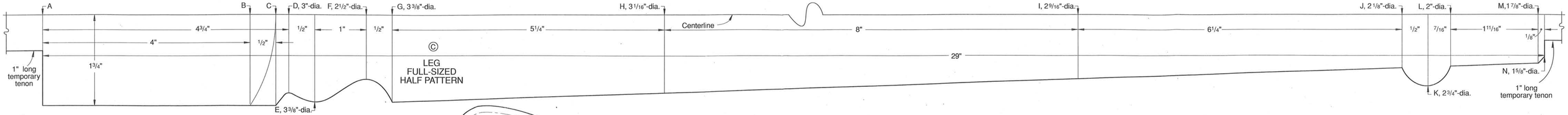

KITCHEN TABLE LEGS
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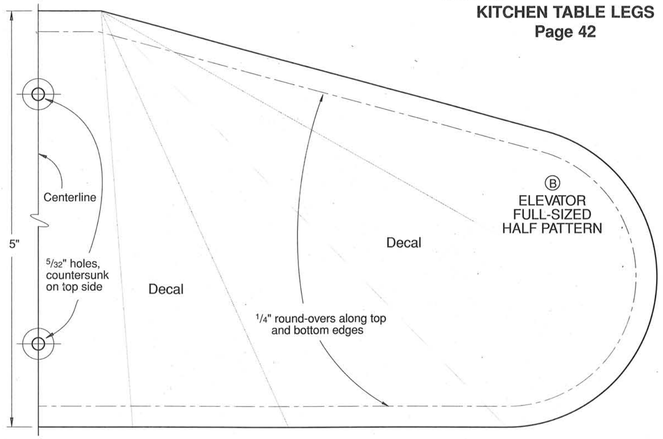

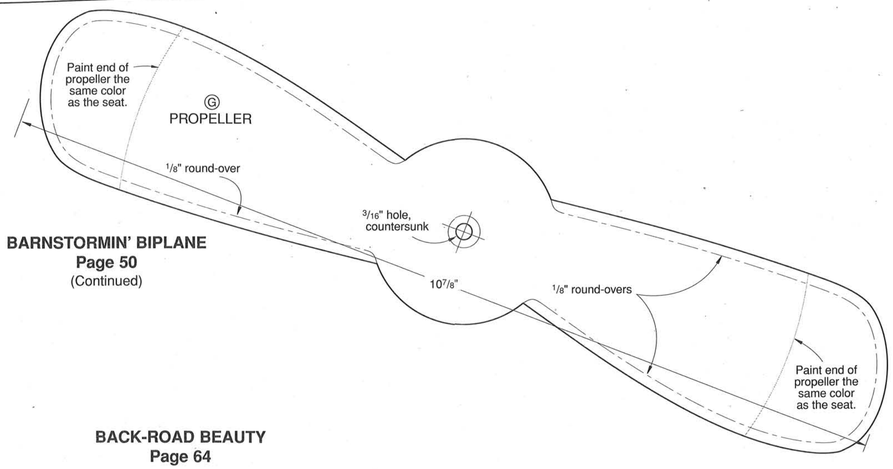

BARNSTORMIN' BIPLANE
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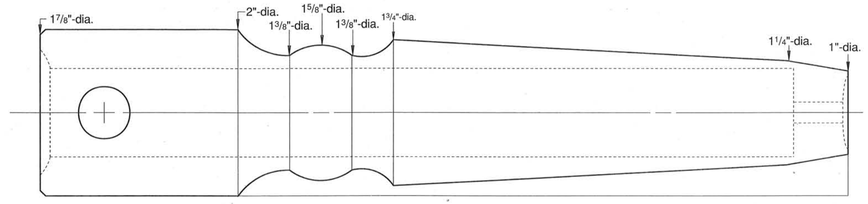

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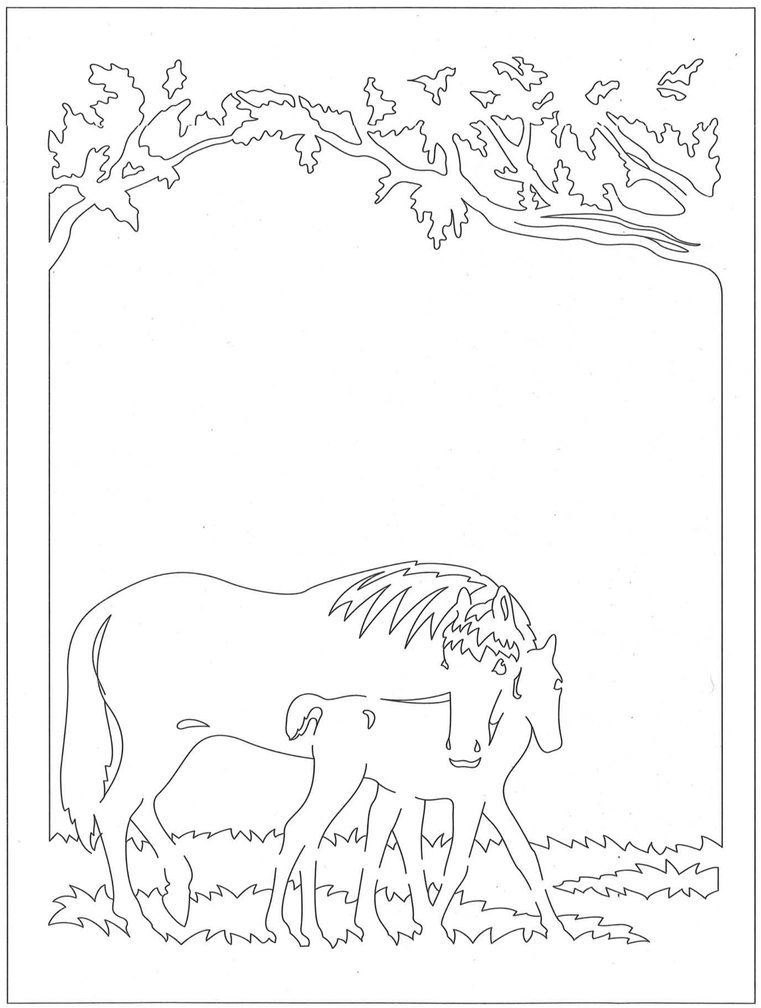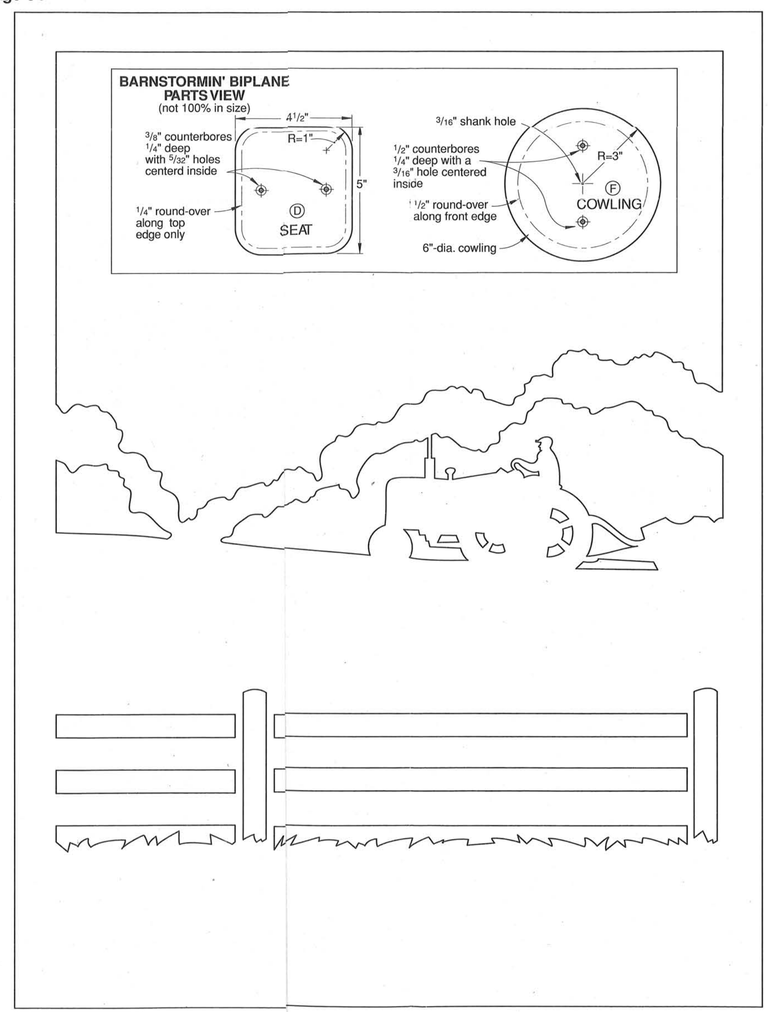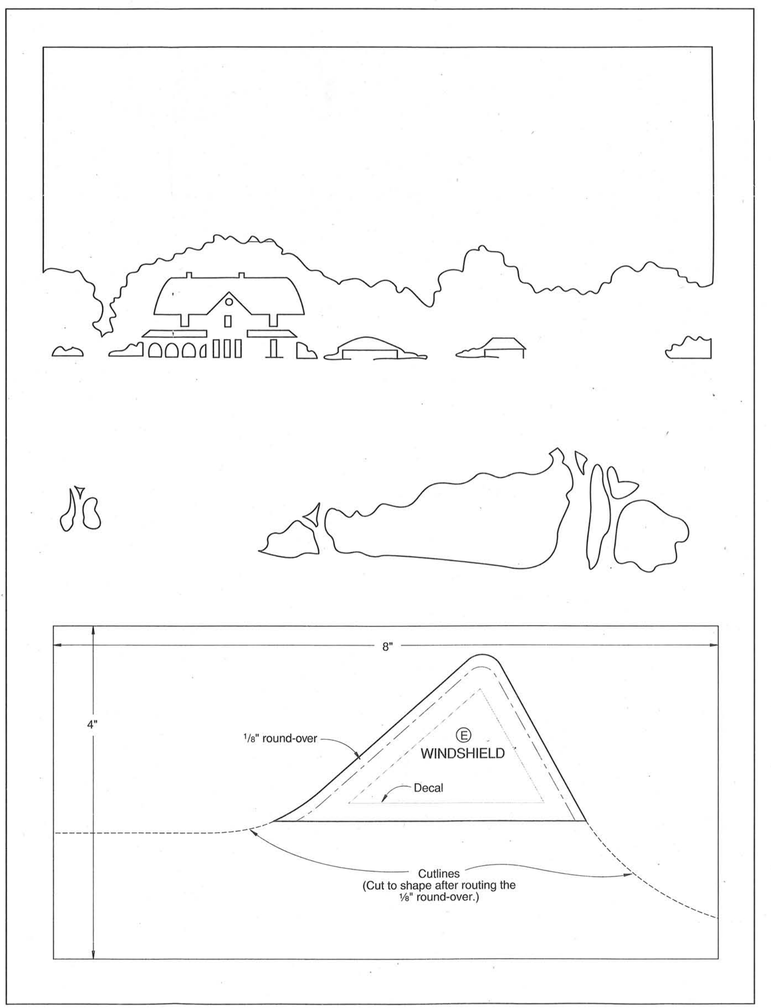
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